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THE

JOURNAL OF AGRICULTURE.

JULY 1851—MARCH 1853.

NEW SERIES.

WILLIAM BLACKWOOD & SONS, EDINBURGH,
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NOTES OF A RECENT TOUR IN GERMANY.

Any person walking through the thoroughfares of our great towns sees bills of sales, and tempting opportunities of making purchases at "an immense sacrifice" on the part of the sellers. Those who are constantly in the habit of seeing such apparently desirable means for the investment of their superfluous money, pass on totally indifferent to the apparent opportunities thus afforded them of realising bargains.

Now there are two principal reasons which create this indifference: *first*, prudent persons think it no economy to purchase articles which they do not really want, merely because they may be cheap; and, *secondly*, because they have learned, either by their own experience or by that of others, that full credence is not to be always placed in the seductive offers of sale put forward by the venders. Damaged goods are sometimes thus bought, and so passed off instead of sound ones; so that the purchaser, deceived by appearances, discovers that his cheap purchase is in reality a dear one.

Let us apply this to the advertisements of bills of sales of properties in Ireland under the "Encumbered Estates Act."

We have frequently seen notices of the sale of broad acres, in large and small lots of all descriptions, of soil of the finest texture, with adjuncts of tenements in the best order and costly structure, and with scenery which can bear competition with that of the most favoured countries; yet capitalists who are actually looking out for desirable objects in which to invest their money, pass on untempted to enter a mart where such sales are offered. How is it that men who will expend money in the most adventurous schemes of commercial speculation—men who are often satisfied to receive 3 or 4 per cent on their invested capital—are reluctant to become purchasers of *bonâ fide* estates, with indisputable titles, obtained without delay? Do they apprehend fraudulent repre-

sentations as to the extent or intrinsic value of the properties offered for sale? Do they fear dishonest collusion, or any trickery on the part of the official personages who manage the sales? Do they think that the representation and circumstances of the land are too highly coloured, or falsely drawn? The most rigid scrutiny is within their own power, and even invited; while the *salesmen* are without spot or reproach, and, unlike the shopmen in the thoroughfares of our cities, have no individual interest in puffing the goods in sale.

In this case, as in that which we have adduced for the sake of some exemplification of our object, two causes for this unwillingness to invest money in Ireland are distinguishable: *first*, the supposed insecurity of life from agrarian outrages; and, *secondly*, the deterioration of the value of land, caused by the impoverishment of tenants and consequent non-payment of rent, added to the fiscal burdens imposed upon the land proprietary, and the uncertainty of any decided and lasting improvement of Ireland. To enter fully into the consideration of these important points would oblige us to extend our limits too far. We think, however, that the reasons we have supposed to be assigned for the unwillingness to purchase land in Ireland are so much more imaginary than real, that a brief but exact analysis of them is sufficient to dissipate misapprehensions on the subject.

As to the first—unhappily agrarian outrages, accompanied with loss of life, are of frequent occurrence, for which the shadow of defence cannot be offered on either moral or religious grounds. But, we would ask, are they of sufficient extent, character, and description, as to deter colonists from settling in the country?

We have looked narrowly and dispassionately into this point, and we find that the terrible outrages which have tainted the country so fearfully have not extended beyond certain localities, leaving the rest of the country in a secure and healthy state; and we have in vain looked for any clear case of the murder of a purchaser of estates, of any tenant-farmers who have settled in the country, and who have acted uprightly and honestly, giving fair employment and remunerative wages to the labouring population around them. To one, and only one cause, are we able to trace almost if not every murder which has stained the annals of the country—viz., the competition for small allotments of land; and this cause has materially decreased from emigration, and the decimation of the people by famine and its results. From an intimate knowledge of the people and their wants, we have no hesitation in saying, that, far from their now feeling hostility to a stranger as such, his presence among them as an employer and judicious improver would be cordially welcomed.

As to the second cause of unwillingness to purchase land in Ireland—viz., deterioration of its value, and impoverishment of tenants, &c.;—the deterioration of the value of land we look upon

as merely temporary, and would urge it as a reason for its *present* purchase. The impoverishment of tenants must cease with a fair adjustment of rent, and the preliminary assistance as regards capital for proper cultivation of their farms which landlords of capital could afford them. The punctual payment of rent would, under such circumstances, be as certain as in any part of Great Britain. We see no reason why this should not be so.

Poor-rates, which have pressed so intolerably upon certain districts in Ireland, are already diminishing greatly; and, under an improving condition of the country, there is no reason to think they would be heavier than the land could reasonably bear. It must be recollected that Ireland has been unused to poor-rates, and, unprepared for their pressure, has felt them the more acutely.

We think Ireland has seen the worst, and cannot therefore fall lower. On the contrary, we see every reason to predict a very decided and rapid change for the better. Channels for the investment of capital there are opening every day; and men of enterprise and wealth are making it the field for their industry, sowing the seeds of a rich harvest.

It may not be uninteresting to institute a comparison between Ireland and one of the best circumstanced German states, by which it will appear that the burdens on land are not so heavy in the former country as in the latter; while in this the prices of agricultural produce are lower, and land sells at a much higher rate.

The Duchy of Nassau, which we select for illustration, contains 1,812,541 morgens,* equal to 1,131,025 acres, which is a little less in area than Somersetshire, with about the same amount of population—viz., (by the census of 1845,) 417,708 individuals. The number of proprietors and tenants of land was at that time (exclusively of about 2000 owners of vineyards) 44,146; and of agricultural labourers, shepherds, &c., 18,517. The number of tenant-farmers is very trifling, and almost all the large farms—large by comparison—are in the occupation of the proprietors themselves.

The largest farm within the radius of four miles from Wiesbaden does not exceed 300 morgens, and the average quantity occupied by agriculturists of all grades is a small fraction above 12½ acres. The *minimum* to which subdivision of land may be carried is limited, by a law passed in 1809, to half a morgen! and this limitation, no doubt, was made with a view to fiscal convenience, as it would be intolerably troublesome to collect land-rates from the holders of more minute allotments. We shall explain the mode of levying rates in Nassau. Taxation there is imposed by a system of rating (established about eighty years ago) called a *simplum*, which is increased or diminished according to

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* The morgen is 624-1000th of an acre. In round numbers, about eight morgens are equal to five acres.

the financial circumstances of the State. Last year the taxation was about one-third higher than before the Revolution of 1848—a *blessing* conferred upon rate-payers generally throughout Germany, as a pleasing consequence of popular insurrections. There are 9 simplums now levied upon the land, of which 4½ are for the exigencies of the State, and the remainder for church and parochial expenses. In these respects there is a legal limit to the number of simplums imposable; and the *maximum* which can be levied for the expense of a parish—which includes provision for the helpless poor and for a school—is 3 simplums, and for the church from 3 to 4 simplums. For Government purposes the number of simplums is unlimited. The rates for the maintenance of the poor are not heavy, because they are only supported by their communes (parishes) when in absolute want by reason of old age or infirmity, and if their near relatives are unable to support them.

Under the cadastral valuation, there are six classifications of land chargeable (*ad valorem*) with rates.

The following details, obligingly communicated to the writer of these notes by a gentleman of unquestionable correctness of judgment, resident in Wiesbaden, will in some degree illustrate the general system of rating, and the amount of taxes chargeable on all property. They are fair exemplifications of the burdens imposed on land, houses, and trades. An individual who is a land-proprietor in the country, and a wine-merchant and householder in Wiesbaden, paid, in 1850,—

1 simplum on 21 acres, ...	£0	18	4
1 do. on house, ...	2	1	8
1 do. for license to sell wine, . . .	4	6	8
	£7	6	8

These are separate simplums, but the gentleman was charged with nine of them, viz.—

5 for the State.
2 for the Church.
2 for Municipal purposes.
—
9

He paid, therefore, nine times £7, 6s. 8d. = £66, for one year; of which sum £8, 5s. was the charge on 21 acres, £18, 5s. on house and town property, and £39 for his license to sell wine.

It is a curious fact that the TOWN *octroi* (duty) on wine amounts to more than the freight of wine from Wiesbaden to New York. The wine-merchant pays, in Wiesbaden, 13s. 4d. for leave to bring a cask of wine from his vineyard *into the town;* though he could lay down the same sized cask, if not brought into Wiesbaden, on the quay at New York at the cost of 9s. 2d. The Rhine wines, then, may be drunk in New York (except for American duty) on cheaper terms than in the German town in the immediate neigh-

bourhood of some of the best vineyards. We may state here, also, while on the subject of municipal charges, that the laws of Germany press heavily on industry and discourage competition. No tradesman can settle in any place except that of his birth, or of his wife's birth; and since the recent revolution, this system has been most stringently enforced, to the real injury of the tradesmen, and loss to the consumers of the articles manufactured by them. For instance, an eminent shoemaker of Mayence, which is within a few miles of Wiesbaden, who supplies many of the nobility and gentry of England with shoes, and can undersell the London shoemakers, (under Peel's tariff, by which, on paying a duty of 1s. per pair, foreign shoes are admissable into England,) is not allowed to *take* a bag of shoes from Mayence to Wiesbaden, (he may evade the penalty, however, by *sending* shoes in parcels to his customers there by railway,) under a fine of 10s. for the first offence, and imprisonment in case of repeated transgressions of this foolish municipal law.

We take another case to exemplify the amount of rates and their inequalities charged on land, and also the present estimated value of the soil in the market. A farm of 187 acres of good land at Schirrstein, (some of which, in the wasteful German fashion, is in detached patches here and there among villagers' holdings,) let by the proprietor, Count Bismark, to a tenant at £1, 6s. 8d. an acre, was charged last year with £36, 10s. in rates, besides the church tax, (not tithe, for this has been abolished,)—which, however, was above the average of preceding years. Fifty years ago the father of the present proprietor paid for this property, together with the tithe of the commune, (which, it has been intimated, no longer exists,) a fraction less than £1700. If we suppose the acreable value of the farm, with the buildings on it, to have been £1 per acre, the purchase would have been made on a scale corresponding with that at which some Irish farms have been sold in Dublin under the Encumbered Estates Act—viz., ten years' purchase. But the analogy has ceased in a striking manner. If the German farm were now for sale *in very small lots*, the owner could get for it, from petty mechanics and peasantry—whose anxious desire is to become proprietors—£12,000 *above the original price* paid.

Now, though the market value of this land, if it were offered for sale, is so high, the rent charged for it is very moderate in comparison, yielding to the landlord, after he has paid the rates, but £1, 3s. 10d. per acre. It is impossible for us to state the average amount of rent in Nassau. The farm to which we have just alluded for the exemplification of the burden upon land is near the capital town, and its soil is of very good quality. In some localities there is more competition for farms than in others, from obvious causes. We may, however, venture to quote the rent of land capable of cultivation at from 10s. to £1, 6s. 8d. the morgen. Two per cent upon the actual value of the land is the lowest rent

we have heard of; the market value of land proposed for sale, and the amount of rent paid for it, do not bear any fixed ratio to each other.

It is also difficult to state the average rates of purchase, as so much depends upon the quality of the land, its local position, &c.; yet from 20 to 40 years' purchase may be a tolerably correct quotation. In the neighbouring electorate of Hesse-Cassel, at the distance of eight miles from Frankfort, the directors of a railway company have paid at the rate of £185 an acre for ordinary land! The proprietors of land on a proposed line of railway in the south of Ireland have recently offered to make a *gift* of all the ground required for the purpose, though much of that land is of as much intrinsic value as the German soil in question. This fact (regarding the gratuitous surrender of land in Ireland) is one out of many which might be adduced to prove either the miserably low estimation of land in Ireland, or the liberality of the landowners there, of whom so many appear willing to make such immediate sacrifices for the chances of promoting the colonisation and future improvement of their country by capitalists. The time has been, indeed, when facts were different. We ourselves even have been present at exhibitions of deliberate fraud practised by petty landowners, or tenants with beneficial interests, who, through the agency of perjured land-surveyors of the lowest grade, swearing boldly to the high value of bad land, have put forth claims for compensation which every juror knew to be enormously exaggerated, but which they were either unwilling or legally unable to resist. But when will the period arrive that ordinary land, eight miles from a town, will be worth in Ireland even the fourth part of the sums paid on the German line of railway for land of the same quality, sold without trickery at a fair valuation? Of course we are excluding altogether from the estimates any of the German land under vine-culture.

And here the inquiry suggests itself—Are the productions of the soil of Nassau more valuable than those which, if they *are* not, *might* be raised from the thousands of acres of Irish soil which have been sold under the auctioneer's hammer at 10 or 12 years' purchase of a fair rental, and *that*, too, in the immediate vicinity of mineral manures? Bread and butter and butcher's meat being the chief agricultural productions, we shall place side by side the prices of these and other agricultural products in the markets of Dublin and Wiesbaden.

	Dublin, Nov. 1, 1850. (*From Dublin Evening Mail.*)	Wiesbaden, Nov. 11, 1850.
Beef, per lb.	4½d. to 6d.	4d.
Mutton, ...	5½d. „ 7d.	3d.
Pork, ...	4d. „ 5d.	3¼d.
Butter. ...	7d. „ 9d.	6¾d. to 8d.
Bread, household,	(not quoted.)	2 lb. loaf, 2¾d.
Potatoes, Kemps, per stone of 14 lb.,	7½d.	3¾d.
Oats, per stone of 14 lb.,	7½d.	9d. to 10d.
Hay, per cwt.,	2s. 6d.	2s. 6d.
Straw, ...	10d.	1s. 6d.

From these returns it may be assumed that the prices of beef, mutton, pork, butter, and potatoes are generally higher in Dublin than at Wiesbaden. The quality of the meat is, however, very inferior in the latter market. The prices of hay, oats, and straw would be lower than the above quotations in Wiesbaden in ordinary years, the great increase of cavalry during the recent political agitations of the Continent having caused a temporary rise in the prices of fodder generally. Judging, then, by these market-rates, the Irish farmer has an advantage over the German, unless the cost of the productions be greater in Ireland than in Nassau.

Let us inquire into some particulars bearing upon this point. Are the rates of farm-labourers' wages higher in Ireland than in the German state with which we are instituting a comparison, and, therefore, tending to the disadvantage of landowner and tenant? The wages of labourers in Nassau are 1s. in the neighbourhood of towns, and from 8d. to 10d. in the country districts. These are precisely the rates in the best agricultural counties of Ireland; but higher, we fear, than in the west of Ireland. Is the soil of Nassau superior to that of Ireland? Taking the average fertility of hills and plains in Nassau, we believe that its average fertility is inferior to that of many counties in Ireland—decidedly so as regards her calcareous central ones. Of Limerick and Tipperary, Arthur Young reported—"It is the richest soil I ever saw, and such as is applicable to every wish. It will fatten the largest bullock, and at the same time do equally well for sheep, for tillage, for turnips, for wheat, for beans, and, in a word, for every crop and circumstance of profitable husbandry."

We have examined soil in the vicinity of Wiesbaden, which the occupier valued at 40 years' purchase, and it is very inferior to the rich loams of many parts of Ireland; and if we compare the size and weight of potatoes, or Swedish turnips, on equally well-managed land, we shall find greater produce from the Irish soil. The moisture and mildness of the summer temperature in Ireland are far more favourable to the growth of the most valuable varieties of the turnip than the Continental climate is; and it is probably for this reason that the diminutive sorts—such as the stone or stubble turnip—are, with rare exceptions, the only sorts cultivated in Germany, where they are not sown until after the great summer heat and drought have passed away.

Will it be said that blights are frequent in some parts of Ireland, that the oat crop has been destroyed on the sea-coasts, and that the glory of the potato has passed away? It may be replied, that the mischief to which the agriculturist is liable in Nassau, from thunder-storms, and heavy rains, and hail-storms, which sometimes beat to the earth thousands of acres of corn and destroy the grain altogether—are of much more serious evil than the vicissitudes to which the Irish farmer is liable. The potato crop

failed in Germany too, and, as it is now "itself again" in that country, there is good reason for hope that it will recover its full vigour in Ireland; though we hope it will never constitute again the sole subsistence of the peasantry. But some admirer of the Tenant League, some ingenious patriot, may fancy that there is a perpetuity of tenure in favour of the German tenant, which turns the scale greatly in his favour; while the poor Irishman is so often limited to a lease of 21 or 31 years, and receives no consideration for having indefatigably over-cropped and exhausted the land committed to his management. Now the leases in Nassau are for 6, 12, and 18 years—the latter is the longest term asked or given; many leases are for 6 years; and in these leases there are always covenants restricting the cropping, the number of cattle to be kept, and especially against sub-letting. As a matter of course, the tenant surrenders his farm at the end of the term, unless it suits his landlord's convenience to relet it to him—and that, too, without bearing any serious ill-will towards him.

If the rule observed in Nassau—that one cow, or equivalent live-stock, should be kept (always house-fed) for every 2½ acres—were followed by Irish farmers on all *arable*, such as grazing land, it would be obvious that their advancement in agricultural practice would be elevated in a degree unimagined by them at present; and that the general fertility and productiveness of the soil would be immeasurably increased if the green crop superseded the corn-growing system—more especially in those districts where the moisture and low summer temperature of the climate, which render it so propitious to the growth of green crops generally, are adverse to the *perfection* of wheat and barley. That the number of live-stock actually kept in the Duchy amounts to the number theoretically maintained according to the ratio above stated, will appear by the following return of the live-stock existing there in 1845:—

Black cattle,	190,253
Horses,	11,592
Asses,	566
Sheep,	150,732
Swine,	79,378
Goats,	21,483

It has been stated that the Duchy contains 1,131,025 acres; therefore the number of black (or equivalents, according to the prescribed ratio of one cow for 2½ acres) ought to be 423,750. Let us now see how far the assertion that it is so is proved by the above returns. Of the million and one hundred odd acres recorded, there are to be deducted from the land maintaining cattle—

Ornamental and garden land,	14,018	morgens.
Vineyards,	15,543	...
Woodland,	736,377	...
Fish-ponds,	1,251	...
Barren land,	140,247	...
	807,736 morgens = 503,840 acres.	

In precise numbers, therefore, 503,840 acres are to be deducted from 1,131,025 acres, leaving 627,085 acres for ordinary farm purposes, on which 235,154 head of black cattle should be kept; whereas, by the report, there are only 190,253 as the actual number, leaving a deficit of 44,901, *unless* equivalents can be produced, which will appear after a moment's calculation. Allowing 8 sheep to be equal to 1 cow, we substitute for the 150,732 sheep 18,841 black cattle, which, added to the actual number of cattle, reduces the deficit to 26,060. To reduce this deficit completely, we have a set-off of 11,592 horses, 566 mules and asses, and 79,378 swine, which are ample equivalents, as means of raising manure. The quantity of live-stock, then, kept in Nassau is truly prodigious, *under the house-feeding system*, and the untiring industry exercised in growing successions of food for them.

Owing to the exertions of the late Mr Blacker, and the liberalities of the landowners for whom he was agent, many small farmers have been induced, in the north of Scotland, to pursue an analogous system of economical husbandry, by which they were enabled to keep live-stock somewhat in the ratio observable in Nassau; but the example of those men has been but partially imitated in Ireland, whereas on the entire area of Nassau the above high average of cattle-feeding is maintained.

If we compare the amount of live-stock kept in any county of Great Britain, we shall find it lower than it is in the little German state of which we have been analysing the statistics on this important point. In all other respects, however, saving that of house-feeding cattle, and thereby accumulating large masses of farmyard manure, the Germans alluded to are, as farmers, immeasurably below the English standard. Of thorough-draining, for example, they are quite ignorant. The gentleman at Wiesbaden to whom we have already expressed our obligations has been consulted by a young landowner, and two or three persons in humble circumstances, as to the expediency of their going to Scotland as apprentices to some distinguished farmers there—a suggestion which he has strongly recommended them to carry into effect.

No doubt much of the farm economy prevalent in Germany might be most usefully introduced into Ireland, where small farmers abound, if there were habits of order sufficient in the national character to carry them out steadily and systematically. The German, like the Irish peasant, is an admirer of potatoes, and cultivates them almost too generally, but with more regard to the due rotation of culture, and the regular growing of some rye and wheat for his coarse bread. As to rye, though we give the preference in Scotland to oats for supplying a nutritive and muscle-strengthening bread-meal for our peasantry, and relish exceedingly

"The halesome parritch, chief of Scotia's food,"

and do not envy the black rye-bread of the Germans and Belgians,

we are disposed to think that on *poor soil*, in any part of the United Kingdom, rye would be more remunerative than oats. It will thrive on sandy soil, and flourish at a high elevation, and, in Continental agriculture, rates in the markets at 4 to 5 compared with the value of wheat. We have seen persons of *all* classes in Germany eating rye-bread at table in *preference* to the finest wheat bread; and the sour taste which usually distinguishes it, and which to our palate was detestable, is highly relished by those who are accustomed to it. Like other acquired tastes, it becomes captivating. In all the rotations of Germany and Belgium, rye holds a place, even on soils suitable to wheat. However, we have no desire to displace oats for rye, on soils and in climates suited to the former grain, which is, in our judgment, far better—and the straw of which, as fodder, is so much more valuable.

Reverting to the consideration of the present depreciated value of land in Ireland, comparatively with the high value of land in Germany, where the value of its productions is ordinarily lower than in Ireland, we express our conviction that the market value of farms in the latter country will speedily rise, under the various circumstances which are combining to improve the political as well as the agricultural state of that country. One or two decided advantages which invite the capitalist to invest money in the purchase and culture of the Irish soil ought not to be overlooked at the present moment. There are no assessed taxes in Ireland—there is no income-tax there; and the land-rates, on an average, are even now less than in England, and they will become less. If an Englishman calculates what he pays in England for income, for window-light, for a man-servant, the horse he rides, and the carriage he drives—except under certain limitations—he may be led to perceive that a residence in Ireland is worth thinking of, and that the investment of his money in the purchase of land and in farming there may not be a bad speculation.

AGRICULTURAL ARCHITECTURE AND ENGINEERING.—No. I.

By R. S. Burn, Author of *Practical Ventilation.*

Of late years, considerable attention has been paid, by those interested in the progress of agriculture, to the details of structural arrangements, to whatever class of buildings these may be applied. It is now universally acknowledged that, by a strict attention to the minuter branches of detail, a considerable saving of time and materials is effected. In times to a great extent happily gone by, the habitations provided for the housing of labourers might be said to be comprehended in the pithy sentence, "floor, walls, and roof"—and these formed, in many instances, of by no means the

best material; while, in striking contrast to the human habitations, the condition of those made for the inferior animals truly showed that the little scientific knowledge attained by their owners, in many cases, was only applied where the "bone and sinew" of our inferior animals could be benefited by its application. But in *all* arrangements, a majority of farmers conceived it a waste of time to pay more than a mere passing attention to the rearing of buildings, of whatever description—even those designed for their own domestic use—but lost sight of, or rather were ignorant of the fact, that a great pecuniary advantage was available from adopting improved and scientific arrangements. Now, in most districts the case is widely different. Not only is the taste and skill of the architect and engineer called frequently into requisition for the improvement of landed estates, and the facilitating of the important processes carried out thereon, but the intelligent farmer counts it no less his duty than he esteems it as a privilege, to make himself acquainted with those improvements which may be advantageously adopted in his own peculiar circumstances.

The records of experience and observation which have been made public, in connection with the arts of architecture and engineering, as applicable to the purposes of agriculture, are numerous as they are valuable; but unfortunately for the agriculturists—who, to obviate the necessity of examining them, may not at all times be willing or able to avail himself of professional assistance—they are, from the numerous vehicles in which they are scattered, exceedingly difficult to be got at for the purposes of reference; and even where the expense is laid out, and the books, &c., obtained, from the difficulty of understanding the technical terms with which the subjects may be clouded and mystified, the cases would be very rare indeed where a person so consulting could, from the otherwise valuable sources, glean much available information. For this class the remarks which we shall give under our head are chiefly intended. We shall describe as concisely as the subjects will admit of, and in terms easy to be understood by all, the best and most approved modes of construction, whether applied to the habitations of man or for the use of the inferior animals. The most economical modes of making foundations, walls, roofs, &c., will be noticed, and due attention given to the rearing of healthy structures, so far as drainage, supply of water, light, heating, and ventilation are concerned. Cheap and easily adopted methods of rendering buildings fire-proof will also be given. The construction and arrangements, internal as well as external, of the various forms of farm-buildings will be carefully attended to; and a variety of brief but useful directions relative to the making of limes, cements, sinking of wells, construction of roads, and other matters useful in a farm or landed estate, will be added. Such may be considered as a general view of the subjects intended to be treated of in one branch or division of our subject. In the other, which may be

more particularly termed the engineering portion, we shall give plain descriptions of the best modes of repairing and fitting up machinery, reduced to a few practical rules, whether referring to steam or other agricultural machines or appliances. The whole, illustrated, when necessary, by plans, elevations, and sections, will, we trust, form a valuable and useful compendium of the various subjects treated of.

Having thus given a detailed view of the intention of the paper, we shall at once proceed to the more immediate matter of our subject.

Chiefly to insure regularity and simplicity of arrangement, we shall first notice the constructive arrangement of Labourers' Cottages—many of the details elucidated being obviously applicable to other constructions. In consistence with the practical nature of our paper, we cannot go deeply into the consideration of the question which has been so often mooted, as to the *expediency* of improving the cottages of the labouring population in agricultural districts. However cogent the reasoning and plausible the arguments of the new school of political economists may be, which are urged against improvement therein, we cannot but think that—apart from all other considerations—a healthy population must perforce, from the nature of things, be a valuable acquisition to an agricultural landlord, and a sure means of making their exertions a profit to all. A healthy population must be an industrious one; and when their industry is led into proper channels, it must act beneficially both to themselves and their employers. The sage maxims of modern political economy are not always correct; and we have all along had a shrewd suspicion that the best way of testing their truth was to compare them with the dictates of the common principles of humanity, as set forth in the sentence, "beautiful exceedingly," the real gem of our religion—"Do unto others as you would others would do to you." Tested by this, surely all opinions brought forward, and supported by plausible arguments, against the amelioration of the condition of our poorer brethren, cannot be long maintained. These arguments we could give in detail, and answer—as we are confident could easily be done—their somewhat selfish statements; but we refrain. It is enough for our purpose to know, that many wise and philanthropic men of our day are alive to the importance of improving, on the principles as indicated by science, the condition of those who may be dependant on them; that the efforts of not a few of our noblemen and landed proprietors are directed to the noble and humane purpose of introducing comfort and happiness amongst their tenantry. Surely to ameliorate the state of matters described in the following extract, is a task pleasant to a well-constituted mind. Dr Gilly, the canon of Durham, in describing the *sheds* in which the peasantry were crowded to the extent of eight, ten, and even

twelve persons, in spaces not exceeding 24 feet by 16, thus remarks:—

The general character of the best of the old-fashioned hinds' cottages in this neighbourhood (Norham, on the banks of the Tweed) is bad at the best. They have to bring everything with them—partitions, window-frames, fixtures of all kinds, grates, and a substitute for ceiling—for they are sheds. They have no byre for their cows, no sties, no pumps or wells, nothing to promote cleanliness or comfort. The average size of these sheds is about 24 by 16 feet. They are dark and unwholesome. The windows do not open, and many of them are not longer than 20 inches by 16 inches; and into this space are crowded eight, ten, and even twelve persons. How they lie down to rest, how they sleep, how they can preserve common decency, how unutterable horrors are avoided, is beyond conception. The case is aggravated when there is a young woman to be lodged in this confined space, who is not a member of the family, but is hired to do the field-work, for which every hind is bound to provide a female. It shocks every feeling of propriety to think that in a room, and within such a space as I have been describing, civilised beings should be herding together without a decent separation of age and sex. So long as the agricultural system in this district requires the hind to find room for a fellow-servant of the other sex in his cabin, the least that morality and decency can command is, that he should have a second apartment, where the unmarried female and those of a tender age should sleep apart from him and his wife.

Again another writer says:—

If we follow the agricultural labourer (in Bedfordshire) into his miserable dwelling, we shall find it consist of two rooms only. The day room, in addition to the family, contains the cooking utensils, the washing apparatus, agricultural implements, and dirty clothes; the windows broken, and stuffed full of rags. In the sleeping apartment, the parents and their children, boys and girls, are indiscriminately mixed, and frequently a lodger sleeping in the same and only room; generally no window—the openings in the half-thatched roof admit light, and expose the family to every vicissitude of the weather. The liability of the children so situated to contagious maladies, frequently plunges the family into the greatest misery.

On reading such statements, pictures affording types of the state of the dwelling-houses of the population in too many of our agricultural districts, we ask whether is it likely that a generous mind would coolly argue the expediency of improving such a condition of affairs? No! Rather than vex ourselves with the fine-drawn speculations of political economy, we should do our best to alter such—to bring them more in unison with the principles of humanity and religion; and, in place of stifling the generous impulses of our hearts by darkening counsel by words, we would exclaim with him who thus so eloquently writes—

Oh for a good spirit who would take the housetops off with a more potent and benignant hand than the lame demon in the tale, and show a Christian people what dark shapes issue from amidst their houses, to swell the retinue of the destroying angel as he moves forth among them; for only one night's view of the pale phantom rising from the scenes of our too long neglect, and from the thick and sullen air, where vice and fever propagate together, raining the tremendous social retributions which are ever pouring down, and ever coming thicker! Bright and blest the morning that should rise on such a night! for men, delayed no more by stumbling-blocks of their own making, which are but specks of dust upon the path between them and eternity, would then apply themselves, like creatures of one common origin, owning one duty to the Father of one family, and tending to one common end, to make the world a better place.

Having given what may be considered as the dark side of

the picture, we in the following description have a brighter view :—

On entering an improved cottage, with a neat and cultivated garden, in which the leisure hours of the husband are pleasantly and profitably employed, it will be found that he has no desire to frequent the beer-shop, or to spend his evenings from home. . . . . The cottager feels that he is somewhat raised in the scale of society. He sees his wife and family more comfortable than formerly ; he rises in respectability of station, and becomes aware that he has a character to lose. Having acquired these important advantages, he is anxious to retain and improve them.

Truly did the late Mr Loudon say—

The existing race of labourers can only be benefited by the humanity and kindness of those of their employers who are men of wealth. The unhappy and unsettled habits of common British labourers, whether employed in agriculture or in the manufactures, is most deplorable, and every effort should be made to better their condition ; and I know of no way in which this can be done so easily, as by arranging so as that every married country labourer may occupy a comfortable cottage and garden.

It is pleasing to think that this opinion is held and acted up to by a largely increasing number of our landed proprietors and tenant farmers. On this point, however, we cannot refrain from quoting the following from a recent report of a Committee of the Highland Agricultural Society :—

There is reason to believe that many farmers are justly chargeable with habitually neglecting the duty of attending to the condition of their work-people. It is possible, no doubt, to carry supervision too far, and to accustom the labouring poor to trust too much to the guidance and assistance of their superiors ; but a certain degree of superintendence on the part of their masters, especially when the establishment consists of unmarried men, is a positive duty. By regular attention to the condition of their dwellings, and to such home comforts as he can place within their reach, *he will generally find* his own interest better attended to. The blame of neglecting these matters must, in many instances, be shared by the proprietor ; for although much has been done by this Society in encouraging greater attention to the accommodation of farm servants, and although no one can have failed to remark the decided improvement which has been effected on many estates in this respect, there are still considerable districts where the labourers' dwellings are most insufficient in size, convenience, drainage and ventilation.

We make no apology for the length of these remarks: the subject is one of the greatest importance; and we conceive that it is the duty of every one to endeavour to place it upon a proper basis.

After deciding upon the plan to be followed in the erection of the cottages, (designs for which we shall hereafter give,) the first point to be attended to is, the choosing of the site or position.

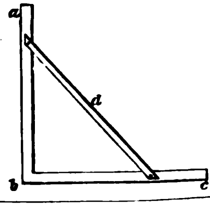
If possible, they should be cheerfully situated—as, for instance, near the public road. This is a more important point than is generally supposed. A cheerful situation has an undoubtedly beneficial influence on the health and spirits; and if careful of the appearance of his house and garden, the labourer may not only give pleasure to the passers-by, but receive that notice and commendation which will urge him on to greater efforts. Dirt and slovenliness thrive best when away from the public gaze.

The position of the cottage should be such that the sun will shine upon it every day in the year. In this country the direction of the front line, to effect this, will generally be north-east, north-west, or south-west and east. It is obvious, then, that the front can only be parallel to the road in certain places. The front, in other cases, must be oblique to the road. When this is done, the diagonal line through the building should be north and south if possible. With regard to the placing of cottages in lines or groups, a competent authority thus writes:—

If any general rule could be given for the laying out building-ground, it would be to avoid everything usually considered essential—long rows of houses all of the same height—semicircular rows, with a tall house at each end, and a taller one in the middle, &c. The ugliness of the common plan will be seen by contrasting the picturesque cities of York or Lincoln with the formal and uninteresting appearance of Bath or Cheltenham; or they may be seen side by side in the old quaint town of Hastings and the modern triumphal-arched town of St Leonard's.* From this cause London, though the largest, is probably the least picturesque city in Europe. Mr Disraeli, in his *Tancred*, has ably contrasted the old part of London with the new, and has pointed out the absence of all interest or character in the modern portions. Strange that he should have been able to see so clearly that which the professors of the art have not only been blind to, but are continually helping to increase.

Sufficient space for a garden should be allotted to each cottage. The size of this will depend upon circumstances. Mr Loudon, however, recommends that it should not be less than one-sixth of an acre for each. All the buildings, such as pig-styes, &c., should be within the precincts of the garden, but of course at the farthest possible distance from the house. A portion of the ground should be left before each house. This will admit of the cottager showing his taste in keeping up a plot of flowers. All such innocent and pleasing amusements are the surest antidotes to the allurements of the public-house: on this point all agree. "If the partitions between the cottages be formed of evergreens or other shrubs, they should not be cut architecturally, as has been sometimes recommended, for the purpose of showing the cottager's taste. If the cottager is to show his taste and ingenuity in no better way than cutting a tree into the shape of a church or a goose, he had much better remain idle." We do not agree *in toto* with this. Better that a man should be busy in executing trifles about his house than dissipating elsewhere; but we think there is much truth and good sense displayed in the rest of the advice. Having determined on the size of the ground-plan, the next step is to mark out the sizes and relative position of the lines on the space of ground where the house is intended to be. The directions we give on this point will also be applicable in the laying out of stables, out-houses, &c. Provide a square as shown in fig. 1. The wood must be well-seasoned

Fig. 1.



* If the above criticism be correct, what will the inhabitants of the New Town of Edinburgh think of the beauty of their part as compared with the Old!

deal, as this is sure not to warp; the limbs, *a b*, *b c*, being some five or six feet long, three inches broad, and half or three-quarters inch thick: the brace *d* will keep the limbs in their right position. The leg *a b* must be exactly at right angles to *b c*: this can be adjusted by means of a small square before nailing them together.

Near the place on which the house is to be built, drive in a stake, and fasten to it a line; stretch this across the intended front line of the house, and fasten it round a stake on a line with the first one. Mark out this line with a spade; at the end of the line where the end corner is to be, apply the side *b c* of the square to it; stretch a cord across the side *a b*, which must coincide with it; fasten the cord to two stakes at each end; mark along the cord with a spade; do this at both ends of the first line, so that the length of the house shall be marked fairly out thereon. On the cross or end lines mark the intended breadth. A line drawn parallel to the front, and the marks on the end lines, will be that of the back. Mark the back line with a spade. The main partitions should also be marked out in the same manner.

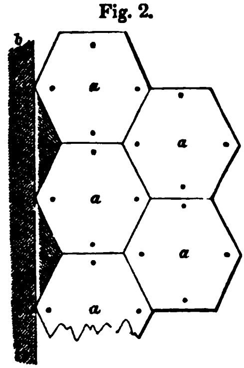
The lines of the house being thus laid on the ground, the next important matter to be attended to is the foundations. A trench must be dug in the ground all round the marked lines, at such a distance on either side of these that the centre of foundation will be the centre of wall. Thus, if the thickness of foundation at bottom is to be eighteen inches, a space nine inches on each side of the marked lines will be required. The depth of the trench will depend on the nature of the soil; when it is very strong and firm, from nine to twelve inches will be sufficient. The thickness or breadth ought to be twice that of the walls. This, however, will depend very much upon the soil; if in soft and loose ground, it is evident x firm that they should be thicker than when it is hard and ~~soft~~. Generally the proportion of foundations to walls is as above—two to one. The requisites for good foundations are, means for preventing inequality of settlement, and the escape laterally of the supporting materials. The bottom of the trench should be perfectly level; and to effect this, the spirit and common mason's level should be frequently used in the course of the work. The foundation ought to be carried up sloping; that is, each course to be diminished, so that the lower one shall be broader or thicker than the one above it, or from which the walls spring—care being taken that the centre of upper course shall fall exactly plumb, or on a line with the centre line of wall. A rocky or compact gravel is the best material that a house can be built on, so far as obtaining a good and secure foundation is concerned. In rocky ground, if the same level cannot be kept throughout, the ground must be cut into horizontal steps, or "benched out," as it is termed, so that the courses may all be of the same level. To prevent unequal settling, which will be more or less according to the quality of the

work, the foundation, in loose shifting soils, should be brought up to an equal level with blocks of stone or layers of concrete. Some soils forming good foundations when protected from the weather, become, however, useless when exposed. Thus blue shale, which is generally very hard when first opened up, by its capacity for moisture, in damp weather especially, runs into sludge or mud. Where soils of this kind happen, the parts exposed should, as soon as possible, be protected from the action of the atmosphere by covering them with concrete. A simple kind of concrete is made of sand and gravel with a little lime.—(See Remarks on Limes, Cements, Concretes, &c.) In a future portion of our remarks, we shall return to this part of the subject, pointing out the plans to be adopted in cases of peculiar difficulty, which in large estates may be often met with. In cases where the walls are made *en pisé* or other simple material, a sufficiently secure and cheap foundation can be made by throwing largish-sized stones into the trench, mixed with a little earth, and ramming them very tightly with a heavy rammer. The stones should be put pretty evenly in, and a few inches deep at a time, proceeding thus till the level is reached—care being taken to have the foundation perfectly level throughout.

The next points to be considered are the laying of the ground-floors, and the making and the placing of the drains. The great point in determining the material of which the floor is to be made is the prevention of damp. While, on the one hand, the records of experience prove that there is no cause so fruitful of disease as damp living rooms, it is equally true that a dry house, *cæteris paribus*, must be healthy. In very damp situations, the house, says Mr Allan, may be built on an artificial platform, constructed of brick or rough stone-work: this may be from 18 to 24 inches high. An economical and dry ground-floor can be made as follows:—Ram the bottom hard and smooth; make a concrete, formed of clean gravel sand, a little lime, and common coal-tar; lay this mixture evenly on, and, when sufficiently hardened, cover it with a layer of cement formed of three parts sand to one of Roman cement—this layer being two inches thick, which must be carefully smoothed at the top-surface. Lime-ash floors are very durable and economical; they last for many years, and require little or no repairs. An approved method of making them is the following:—"The sand to be used, after being well washed, and freed from earth, is mixed with lime-ashes, in the proportion of two-thirds sand to one-third lime-ashes, both thoroughly mixed together. It is then, after being suffered to remain for two or three days, tempered with water, and laid on the ground, or other surface, to be covered, to the depth of about three inches. In two or three days it becomes sufficiently hard to bear treading on, and is then beaten all over with a wooden mallet till it becomes perfectly hard, using, at the same time, a trowel and a little water, to render the surface as smooth as possible." For cottage ground-floors, we

would recommend asphaltum to be used: it has been adopted in similar cases with marked success, and we are not aware of any valid objection against its use for cottage floors. It is preferable, in every point of view, to stone or porous brick. An asphalte can be made by mixing boiled coal tar with powdered chalk or bricks. Dr Ure, a high authority, says it is equal to the natural kind. The mode of laying asphalte floors is simple. Place a layer of small gravel stones, about six and a half inches deep, in a dry and well-beaten foundation; pour the asphaltum, (which must previously be melted in a cauldron,) when boiling, over this to any convenient thickness; spread it smoothly and press it down; sift some very small powdered stones over the surface, press them down with a flat wooden trowel, and, when hardened, the operation is finished. The best material that can be used for the laying of ground-floors is hard glazed earthenware tiles or slabs: these would imbibe no moisture, be easily kept clean, and may be looked upon as nearly indestructible. Some objection may be made to them on the score of expense, but, if largely used, they could be produced very cheaply. If made square, they might be set angularly, presenting this way a neater appearance: if perfectly plain, they would be cheap. Hexagonal or six-sided tiles would bind well in with one another. The best mode of making floors with the top covering of tiles would be thus:—Well beat the bottom of the foundation; place a layer of stones on this, of sufficient size to pass through a ring one and a half inches diameter; pour over this a mixture of coal-tar and clean sharp sand —three-parts of the latter to one of the former; press this closely down; when partly consolidated, throw on another layer of stones, and above this another of the tar and sand. When the upper is nearly consolidated, but not hardened, place the flat tiles, beginning at one end, and advancing in such a manner as to leave no footsteps on the soft material. Instead of tar and sand, consistent clay in a partly fluid state may be used, and allowed to consolidate before the tiles are laid on. The tiles should have projecting knobs or snags on their under side, which would, when pressed into the soft materials beneath, keep them in their places. If, however, the tiles were hexagonal, there would be sufficient bind to keep them in their places. Fig. 2 represents the position of the hexagonal tiles; the round dots represent the position of the projecting knobs or snags on the under side; *a a*, the tiles; *b b*, the line of wall; as the tiles, from their shape, will leave in some places triangular spaces, as *c c*, these may be filled up with cement or asphalte, or pieces of tile might be made of the shape: this

Fig. 2.



will be the same size at all places, the angles being invariably equal. Fig. 3 represents the position of square tiles laid angularly, having projections or tongues on one side, with corresponding grooves to fit into them; *a a*, the tiles; *b b*, the tongues and grooves. We have now to describe the plan of making ground-floors, the upper materials resting on hollow pots placed beneath. "The earth of the room to be floored is made hard and level, and unglazed *earthen pots*, about a foot in height, are then placed with their mouths downwards, and close together, over the whole surface; the vacant spaces between the pots are then filled in with pounded charcoal, and over the whole a floor is formed of coarse brick-dust and lime, well worked together. Common flower-pots would answer the purpose, as in the figure; but they would be better if made with a ledge on the under rim, and thereby offer a much firmer resistance to the pressure above than the mere edge of the pot. The space between the pots may, of course, be filled in with any kind of dry rubbish, (charcoal being expensive,) and the floor formed of lime-ash, as above described." Fig. 4 shows the arrangement of this form of flooring: *a a* are the hollow pots; *b*, the charcoal or other material filling up the spaces; *c c*, the flooring material above; *d d*, the foundation on which the pots rest. Fig. 5 shows the pot with the ledge: *a*, the pot; *b b*, the ledge. This will prevent the pot from sinking into the ground from the pressure above, as would likely be the case with pots as in fig. 4. If the pots were made hexagonal, and of the same diameter throughout—instead of tapering, and have projecting snags or grooves on their sides, reaching from top to bottom—then no spaces would be left between the pots to be filled up with charcoal or dry rubbish, as at *b*, fig. 4; but being placed close together, and bound by means of the tongues and grooves, the flooring tiles could be placed at once upon their upper surfaces. Fig. 6 shows this arrangement, the upper figure being an elevation of two pots, *a* and *a*, placed together, the under being a plan of one, *a*, showing the tongues and grooves, *b b*. If the pots were made hollow, as shown in the plan, the inside of each would require to be filled up with dry rubbish, if any other flooring was used than those we have described, save the flat

Fig. 3.

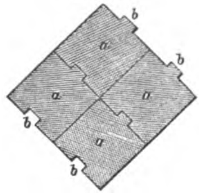


Fig. 4.

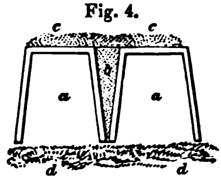


Fig. 5.

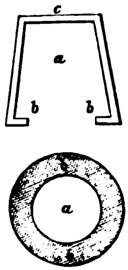
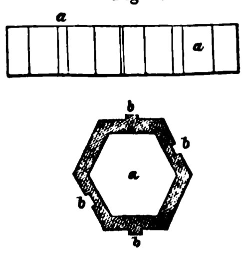
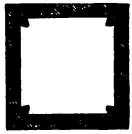


Fig. 6.



tiles. An easier method of obviating this than by making them altogether solid, is by making one end only solid—say for one inch in depth: this would correspond to the bottom, *c*, of the pot, fig. 5. Hollow bricks—which are fast coming into use—are admirably adapted to ground-floors; if the sides are $\frac{3}{4}$-inch thick, the upper side not less than $1\frac{1}{4}$-inch thick, $4\frac{1}{2}$ inches wide, $3\frac{1}{2}$ or 4 inches deep, and 9 inches long, sufficient strength would be obtained. Fig. 7 shows Rawlinson's improved form of hollow brick: they can be easily made by a tile-machine. The following is Mr Roberts' plan of forming hard, cheap, and durable floors:—A foundation or substratum should be prepared about 6 inches thick, with coarse gravel, or brick-bats and lime-core, well beaten to a level surface. In damp situations, tar may be added to the concrete on which the ash-floor is to be laid, thus prepared: Take good washed sand, free from all earth and stones, together with the ashes of lime fresh from the kiln, in the proportion of two-thirds of sand and one-third of lime-ashes, (where obtainable, the substratum of the third portion of smiths' ashes, or pounded coke for one-half of the sand, increases the durability and hardness of the floor;) mix the sand and lime-ashes well together, and let them remain in a body for a fortnight, in order that the lime may be thoroughly slaked, then temper the mortar, and form the floor with it three inches thick, well floated, and so worked that it be not trodden till it has lain for three days, or according to the dampness of the weather; when it should be well rammed for several successive days, until it becomes hard—taking care to keep the surface level; then use a little water, and smooth it with a trowel; after this keep the floor free of dirt, and when perfectly dry it may be rubbed over twice with linseed oil, which gives the appearance of stone instead of sand. The price paid for such floors is about 6d. per yard for labour, and 8d. for material.

Fig. 7.

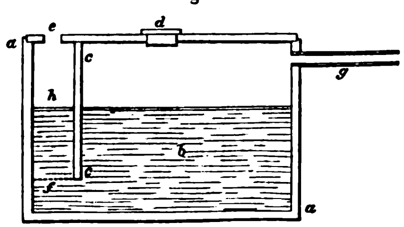


The importance of efficient *drainage* need not be here dilated on. It is now well known that defective drainage is inducive of a large amount of suffering. An eminent medical authority on this point says he believes "that the immediate and direct cause of fever to be a poison generated by the decomposition of animal and vegetable matter." We could multiply instances of this nature, but such we deem unnecessary.

We cannot be expected in this part of our paper to go deeply into the consideration of our subject, important as it is, or point out, more than by brief outline, the essential requisites for securing good drainage in all circumstances. But we trust to be able very briefly to describe easily adopted plans applicable to cottages. In the first place, it is necessary to understand that all systems are thoroughly defective in which the cess-pool is employed. On this point one of our best authorities says:—

"The great importance, however, of avoiding all sources of unwholesome and offensive effluvia, and of preserving the foundations of buildings and the substrata of the soil in a dry and clean condition, creates a severe necessity for relinquishing cess-pools and all receptacles for sewerage within or connected with all buildings and places whatsoever, except *those to which it is conducted for the purposes of collection and treatment.* The sole purpose of all house apparatus of water-closets, sinks, and drains . . . . should be that of affording a passage for the conveyance of the refuse waters and other matters produced. This conveyance *should be immediate*—every particle committed to the entire ramification of passages being preserved in ceaseless motion until it arrives at the final collecting place." In discarding cess-pools, then, it is requisite to make a receptacle to contain the liquid exuviæ, which is in any case too valuable to be thrown away. Useful as liquid manure is, either in arable land or a garden plot, it would be utterly inexcusable in an agricultural district to adopt a plan of drainage which would result in its loss. The liquid manure-tank should be placed as far from the house as possible. The form generally used is an excavation made in the ground, lined with brick set in waterproof cement—the covering being domed if of brick, and flat if of timber, and provided with an opening having an air-tight cover, through which admission is obtained to the interior, to enable it to be cleaned, from time to time, of the solid matter. One mode of withdrawing the liquid is by having a well of the same depth as the tanks close to it, in which the liquid runs, leaving the solid matter in the larger space. However cheaply, in some districts, a brick-lined tank may be constructed, the plan now becoming extensively used—of having the excavation lined with deal boards, and covered with sheets of gutta percha—is worthy of general adoption. It is likely to supersede all other plans, especially where cheapness is considered. The gutta percha is manufactured in sheets of any degree of thinness, and the joints can be made waterproof by simply passing a hot iron over the edges, after being fastened to the deal boards forming the lining of the excavation. If a rough excavation were made of sufficient depth, a strong wooden box lined with gutta percha might be put in this, and the earth closely rammed down all round it. A cover (the under side of which should also be lined with gutta percha) should be provided, with a man-hole door having an air-tight lid. The following sketch, fig. 8, represents a modification of an improved liquid manure-tank described by Mr Allan:—*a a* is the

Fig. 8.



dealboard-lined tank; *b* the body of the tank; a division *c c* is placed at a convenient distance from the end—say 12 inches in a tank the length of which is 5 feet—and stretching right across the breadth: this division is provided with a plate of perforated zinc, placed at the bottom, at *f*. The liquid manure entering from the drain *g* fills the tank *b*, depositing its solid matter at the bottom thereof; the pure liquid passes through the perforated bottom *f* into the division or well *h*, from which it may be withdrawn through the hole *e*; a man-hole *d* is also provided: these should have air-tight covers. As the liquid portion of the manure is the most valuable, by this plan it can be easily withdrawn without disturbing the solid matter.

After thus fixing and arranging the position of the tank, the next point is to lay the drains by which the manure is led from the house thereto. The requisites to insure efficient drainage are as follows:—First, that the form of construction used in drains shall be such that no unnecessary friction or opposition be made to the passage of the liquid matters to be removed. Secondly, that the manner in which the drains are laid shall be that best calculated to promote the quick removal of the liquid—this being best attained by giving them a sufficient fall or declivity throughout their whole length. Thirdly, that all inlets and outlets to the drains shall be properly trapped, to prevent the escape of the gases.

With reference to the first point, experience has fully proved that those drains which have their internal surfaces concave are the best calculated to reduce friction and promote the flow of the liquid through them. This is the most correctly theoretical form, and in this respect at least practice is found to agree with it. In drains where the bottom is at right angles to the sides, or flat, the corners not only collect dirt, but impede the flow of the water. Circular earthenware tubes are now almost universally used for house drainage on improved construction. They are easily laid, the joints made quickly water-tight, and, from the smoothness and shape of the interior surfaces, the friction is much reduced; they are made of all sizes, and have circular bends and junction-pieces, by which proper shaped joints can be readily obtained. One advantage derived from the use of such tubes is, that, from their comparative thinness, they afford a much larger capacity, with a given quantity of excavation, for laying them, than drains formed of brickwork, which, even for the smallest diameter, cannot be less than half a brick thick, or 4½ inches in thickness. The following is a table of prices at which tubes of common clay can be obtained at Glasgow:—

3 inches	diameter,	6d.	per lineal	yard.	
6	do.	do.	9d.	do.	do.
9	do.	do.	1s. 0d.	do.	do.
12	do.	do.	1s. 3d.	do.	do.
18	do.	do.	2s. 0d.	do.	do.

When made of fire-clay, the prices are about double. In London, the straight glazed stoneware tubes, with socket joints, are obtainable in London at the following rates—they may be looked upon as average prices:—

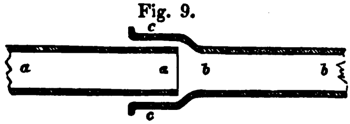
				s.	d.
2 inches diameter,	in 3-feet lengths,	per lineal foot,	.	0	4
3 ditto	ditto	ditto	. .	0	5
4 ditto	in 2-feet lengths,	ditto	. .	0	6
6 ditto	ditto	ditto	. .	0	8
9 ditto	ditto	ditto	. .	1	1½
12 ditto	ditto	ditto	. .	1	10

The price of bends and junctions may be seen from the following table, supplied by Mr Dempsey:—

Diameter of bore.	Bends, each.		Junctions, each.		Double Junctions, each.	
Inches.	s.	d.	s.	d.	s.	d.
2	1	0	1	0	1	4
3	1	3	1	3	1	8
4	1	9	1	6	2	0
6	2	3	2	0	2	8
9	3	6	3	6	4	6

In laying the pipes with socket joints, care must be taken to lay the small ends of the pipes carefully up to the ends of the socket, and make good the joints by ramming into the spaces cement or stiff clay. Fig. 9 shows the general form of socket joints: *a* is the end of the pipe inserted in the socket *c c*; the point of the pipe *b b* is the same size as *a a*; at the other end of *a a* is a socket similar to *c c*. Before the introduction of tubular drain-pipes, little or no attention was paid to the size, so that it was proportional to the liquid to be passed away: to make them large enough was all that was deemed necessary. When the surface of a drain is extended, the fluid, being extended in surface proportionally, is lessened in its motive power, and a sluggish current is the result. By confining the fluid in less space, the velocity is increased, and this insures the removal of the solid matter which is generally found in liquid manure. "The size of the drain-pipes has to be graduated according to the quantity to be passed through them, limited in the minimum extreme, so as to avoid stoppage from the excessive bulk of the sewerage matters; and in the maximum extreme, so as to obtain all the rapidity of progress of which a small stream of water is capable, retarded by the friction of the surface over which it passes. For moderate-sized houses, (say of eight rooms, and holding some five or six persons on an average,) a tube of 5 inches diameter will suffice for the house-drain. The

Fig. 9.



area of the drain may be proportional to the cubic contents of the house, but, if so, in diminished ratio. That is, if a 5-inch pipe will be large enough for an average-sized house, a pipe of double the area of such a pipe will not be required for a house of double the cubic contents, or holding double the average number of persons. A 6-inch pipe, laid with sufficient fall, will be ample for the most capacious private house. When drains of comparatively large size are required to lead the sewerage to a large tank, calculated to receive the production of many houses, the oviform or egg-shaped sewer is generally used.

Fig. 10.

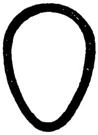
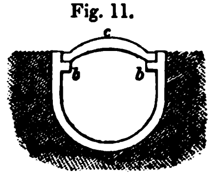


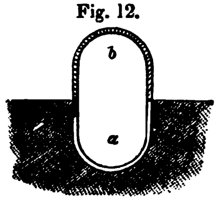
Fig. 10 shows a transverse section of this form. The following are the prices of the common size:—In 2-feet lengths, with socket joints, the price per lineal foot, of the size of 1 foot 8 inches by 1 foot, is 3s. 6d.; 1 foot 3 inches by 9 inches is 2s. 3d. per foot; and 9 inches by 6, 1s. 1d. per foot. A very superior kind of drain tubing has recently been introduced, called "Terro-Metallic;" it possesses a superior density and glaze on the interior surface. An excellent form is made of this material, by which joints can be made to fit one another with great exactness, the ends being made of a conical form, so that one point fits into the other. One great disadvantage possessed by circular and other house drains is, that, when required to be cleaned, they have to be broken up: this involves considerable expense and trouble, but can be easily obviated by laying down a drain-tube made somewhat after the manner shown in Fig. 11.

Fig. 11.



The tube *a* is provided with projecting snags *b b*, on which the cover *c* is laid; this can be removed, and the drains cleaned, without injuring them. A cheaper form might be made with the common field drain-tile, as in fig. 12, where *a* is the tile, of sufficient size to hold the sewerage; *b* another tile, inverted: the joint where the two join must be made carefully with clay.

Fig. 12.



In laying drains, of whatever construction, it is essentially necessary to make the joints water-tight. All escape of the liquid only serves to hasten the blocking up of the drains by the accumulation of the solid matter. Water is the only certain vehicle to insure the removal of the solid part, and it therefore should be confined to the drains.

The second point to be considered is having the drains so laid that their position shall facilitate the removal of the manure. This is best done by giving them a fall throughout their whole length. When the quantity of water is likely to be small, the fall or incline should not be less than 2 inches for every 100 feet for a tube 6 inches diameter. When the direction of the drain is changed, care should be taken to avoid right-angled bends: all

changes should be made in a circular direction, the curve being as easy as possible. The resistance to the flowing water increases in proportion to the smallness of the curve.

As the gases evolved from the sewerage matter are inducive, to a great extent, of disease, care must be taken to prevent their escape from the drain to the house, or external air near the house. The best way to insure this is by properly trapping all the outlets to the drains. Fig. 13 shows an improved form of trap, known as Lowe's—it is greatly used: *a a a* is the external part of the casing, generally made of cast-iron, and fitted into the branch leading to the drain; *b b* the line of grating through which the water falls into the interior *e e*. A partition, *c*, prevents the foul air from the drain, which has a tendency to pass up *d d*, as shown by the arrows, from passing through *e e*, and out by *b b*, the only inlet to the drain.

Fig. 13.

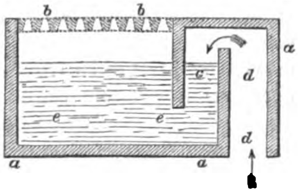
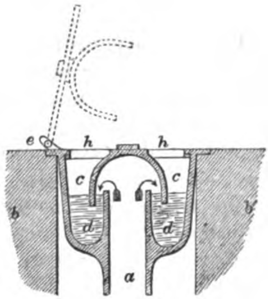


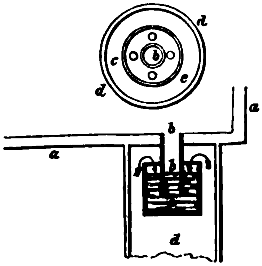
Fig. 14 shows another improved form, called the "bell trap," as described by Mr Allan. *a* is the entrance to the drain, *b b* the stone or brick sides to it; the water passing through the grating at *h h* passes into the receptacles *d d*; the bell or cap *c c* prevents the foul gases from *a* passing out by *h h*, while the water has free liberty to pass into the drain by *a*. When the trap requires cleaning, the grating, which is movable, is moved back, the knob *e* preventing it from falling quite back, and so being forgot. The opening into the drains from the sinks should all be trapped: this ought particularly to be attended to, as these are almost universally situated in the interior of the houses, where the escape of the gases is not only offensive, but doubly dangerous.

Fig. 14.



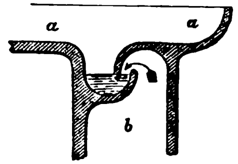
If the sinks are made of earthenware, which is certainly the cheapest material, and infinitely preferable to those made of wood, and lined with lead, the traps may be formed as the same piece. Fig. 15 is a section and plan of an improved form of sink trap, which may easily be made of zinc: *a a* is part of the sink; *b b* the pipe placed at one end, leading to within an inch or so of the bottom of the box *e*, which must have apertures near the top side, by which the fluid can escape; *d* the

Fig. 15.



entrance or pipe leading to the drain. It is clear that no gas can escape through the pipe *b b* to the house so long as the box *e* is filled with water above the opening of the pipe *b b*. Fig. 16 is another form of sink trap: *a a* is part of the sink; *b* the entrance to the drain; this may be formed in one piece, if the sink is made of earthenware. To secure the efficiency of traps, it is essentially necessary to keep them clean: the solid matter should be removed from time to time. As soon as the solid matter reaches to the level where the water can run out, the trap ceases to act.

Fig. 16.



COGITATIONS ON WHAT IS THE FIELD DRAIN.

By Mr Burness, London.

Continued from p. 506 *of last volume.*

In our last we noticed some of the principal phenomena connected with rivers when deflected from the common planes of their inclinations down those of greater, into what was termed safety pools, of equal or greater depths than the sines of their respective planes, and also where the less of two streams falls into the greater. We have now to notice examples where the depth of pools is less than the depth of planes—where pools are not formed—but where the stream flows down either a system of inclined planes or curves; and also where rivers are of unequal breadths, and where the greater of two rivers falls into the less. Tidal and atmospheric phenomena have also to be glanced at. These several heads we shall briefly dispose of in the same desultory way formerly adopted, reserving the treatment of artificial draining in a different manner.

1°. In slow winding streams of small inclination, generally speaking, pools are frequently so shallow as scarcely to be perceptible; for, as far as the eye can discern, their surfaces appear as if they were planes of uniform inclination. It is, however, seldom that this is the case, for in all rivers considerable differences exist as to velocity—a fact with which bargemen and others are familiar from experience, and which only can be accounted for by a difference in inclination. Now, where there is a difference of velocity and inclination, there must of necessity be a difference of depth, a proof of the existence of pools—for a pool is only a difference of depth comparatively speaking.

The shallowness of pools in rivers may be occasioned either by rocks in the bottom, or the smallness of the angle of deflection

from the common inclinations of their channels; and, from what was formerly said relative to the entire retardation of velocity, it will follow as a corollary, that retardation in this case will be in accordance with the less depth of the pool. This, however, is not all; for, in cases of rock, retardation may be increased by the action of the water against it, so that we have not only the depth of the pool to take into consideration, but the opposing character of the rock in the bottom—for the formation of the latter may be such as entirely to annihilate velocity. If, for instance, we suppose that a river 4 feet in depth descends an inclined plane 16 feet in height, and that at the bottom of this plane a ledge of rock rises perpendicular to it to the height of 4 feet—the depth of the pool—so that its top is covered by 4 feet of water, being on a level with the top of the *wear* on the opposite end of the pool—then it is evident that the velocity of the stream will be wholly counteracted by it, and that the stream will issue from the pool in a state of comparative quiescence. For in this case, although the depth of the pool is only one-fourth of the depth of the incline, yet, from action and reaction being equal and in opposite directions, the whole force of the current is wasted upon the rock. In other examples, where rocks rise less abruptly, retardation will be less.

2°. A system of inclined planes, or curves, may be either convex or concave; but in nature there is no such thing to be found as a regular system of either planes or curves, all her examples being of a mixed character—alternately from plane to curve and curve to plane, in the most irregular order. This, however, is of little moment either in theory or practice; for, leaving out of consideration, in the first place, the loss of velocity which is sustained in passing from one plane or curve to another, the velocity acquired in descending any system of either is as the sum of the sines. Now, the losses sustained in passing from one plane to another is proportional to the versed sine of the inclinations of the planes—consequently, we have only to deduct this latter in order to obtain the former.

As we have already said, water in descending inclined planes or curves is governed by the same laws as solid bodies; while it is subject to laws, at the same time, peculiar to itself, such as equal pressure in all directions, and in proportion to its vertical height. In further illustration of this, we may observe, that in its descent it is first acted upon by gravitation, and therefore presses upon the inclined plane perpendicularly to the horizon, and with a weight equal to its altitude—and this weight, in equal times, will be inversely as the velocity. Again, having acquired a certain velocity along the plane, it will have a tendency to pursue the same direction beyond the limits of that plane—hence the phenomena which takes place in passing from one plane to another. And lastly, it is not only subject to friction and adhesion, in common with solid bodies, but also to have its volume divided into different

currents having different velocities, and, from these acting in opposition to each other, the general velocity of the whole is retarded. These currents are occasioned by projections or hollows in the channel. Farther, a solid body, in moving down an inclined plane, retains its form. If it leaves the top of a rectangular form, for instance, it arrives at the bottom unchanged; but in the case of water it is very different, and that, too, in reference to more important phenomena than the diversity of currents just noticed; for the particles of any vertical section of a river which pass any point in its channel in union together, as it were, never pass another point together, because, as we formerly stated, the velocity at or near the bottom is different from that at the surface, and consequently the areas of different sections in any inclined plane where we have accelerated motion are different. If, for instance, for the sake of argument, we suppose that the top section contains 1000 particles when it leaves any pool from a state of quiescence, and that it acquires an accelerated speed of ten times by the time it arrives at the bottom of the plane, then 100 particles will be the number in the bottom section; and, in accordance with this train of argument, we can easily conceive an example where the increase of velocity would be such as to effect a separation of particles altogether. Indeed, it may not unaptly be said that water flowing in a river is not one body descending an inclined plane, but innumerable bodies in close continuation, the one urging forward the other in such a manner as to preclude the intervention of perceptible space between them.

3°. The unequal breadth of streams, or the contraction of their channels at any points, form pools, and consequently counteract velocity in a somewhat similar manner as differences of inclination, formerly noticed. When examples of this kind occur in the absence of rock, we invariably find a pool at the most contracted point. This arises from the increase of velocity and greater depth of water at this point, and consequently greater force brought to bear upon the work of excavation, until counteracted by the rising of a *wear* in front, and the formation of a safety pool of a sufficient depth below the level of the ordinary bed of the river. We have already noticed the formation of *wears*, and their ultimate liability to destruction under heavy floods: when such is the case, a species of natural banking is carried on, sometimes on the one side of the river, sometimes on the other, and not unfrequently on both, so that the lands immediately adjoining are higher than those more remote. We know instances where the difference exceeds twelve feet, and in cases, too, where a large and rapid stream is greatly contracted at a short distance below it, so that during heavy floods the water tails back over the less elevated lands with a velocity greater than even men and horses can conveniently remove themselves from them, when overtaken unawares at work, as they sometimes are. On many of such occasions narrow escapes

are made, and not unfrequently heavy losses sustained. The cause of such tailing back is easily accounted for; for if, under ordinary circumstances, the depth of the stream, when it is contracted, is one-half greater than its common depth, it consequently follows that when the common depth is increased, as under a flood, the depth of the contracted part will be more increased, and hence rise above the less elevated lands.

Again, as the water issues from between the contracted sides of the channel, into a channel of equal or greater than its common breadth, we have the velocity retarded by two causes, even granting that the bottom and sides of the channel are comparatively free of any asperities, presenting a smooth surface to the action of the water: for we have first the reaction of the expanding shores against which the water has been sent; and next, the counteracting agency of a diversity of currents created by this reaction. The phenomena are these: After the stream has passed the narrow, and is entering the expanding channel, its surface will indicate as if it were flowing down an inclined plane, although the reverse may be the case; and this inclining surface will be found highest in the middle, like a ridge, and of a curved form—convex towards the top of the ridge and concave towards the bottom, like a wave, so to speak. This ridge is occasioned by the natural tendency of the stream to move forward in a straight line, and the want of adhesion of its particles among themselves. Were it possible to suppose the water moving forward in a frozen and solid state, it would then issue from the narrow channel in a rectangular form, like clay from the die of a brick-making machine; but deficient of this cohesive quality, the outside particles diverge laterally towards the expanding shores, from whence they are deflected back—forming, as it were, a system of currents; while the action of these tail back other waters, forming a wave or ridge along the extreme of the concavity at the bottom of the inclination. It is this reverberation of water from the shores, and its tailing back, which is the principal cause of this concavity, and the convexity towards the top of the inclination arises from the disposition of fluid particles to conform to the path of projectiles; but the path of a side particle of water, so to speak, will not be in one vertical plane. From these phenomena, therefore, it is very obvious that the velocity of the stream will be greatly retarded by the amount of attraction and reaction.

Perhaps the most familiar examples of the contraction of streams are those occasioned by the piers of bridges. In cases of this kind an increase of velocity is experienced under the bridge, while, at the same time, the common velocity of the stream is retarded by the bridge. The velocity of the water a short distance always above, and generally below the bridge also, is less than at a greater distance from it. In such cases, pools are formed with all the counteracting agency both above and below—the former by the

tailing back of the waters, and the latter by excavation and the formation of *wears*.. A large river may flow smoothly in its channel with a uniform motion, comparatively speaking, and consequently be of equal depth; but throw a bridge over it with a number of arches and piers, and the rising of a sand-bed at no great distance below it is soon experienced by bargemen plying on its surface. Now the rising of this sand-bed is neither more nor less than the formation of the *wear* of a safety pool, to contract the work of excavation below the bridge; so that the depth of this pool will depend upon the height to which the water above the bridge is elevated by its piers, and the character of the materials of which the channel of the rivers is formed, for the elevation of the water above the bridge, confers upon its descent all the properties of descending an inclined plane of equal height; while the altitudinal pressure of water, and the absence of that plane, confers upon the lower stratum of the stream a peculiar, or, as we may say, comparatively speaking, curvilinear motion, with its concavity upwards, calculated to form a *wear* of sufficient strength and pool of sufficient depth to counteract both the altitudinal pressure and force of water in descending from the elevated pool on the upper side of the bridge. This curvilinear motion at the bottom is occasioned by the lower stratum of water starting from a state of comparative rest above the bridge at a less angle than those above it with a greater velocity, and its rolling along with it stones and such heavy materials, to form the *wear*—requiring a considerable force to remove them from one point to another, the larger stones forming as it were a kind of protection to the less. Now the consequence of this is, that the lower stratum of water is deflected upwards against the second—the second against the third, and so on—conferring upon each a different direction, which, if not a curve, must approximate pretty closely to it. Looking, therefore, at a longitudinal and vertical section of the stream at the centre of an arch, we will perceive bottom and surface currents flowing in curves, with a natural tendency to meet each other at a point at no great distance below the bridge. But, from the disposition of particles in the upper strata to diverge laterally, and the velocity of the intervening strata, this result is prevented. Hence, again, the direction which the several strata of particles take, is governed by laws as absolute as that which regulates the oscillations of the pendulum of a clock.

Sometimes, again, we see deep pools formed immediately outside the piling or paving below the arches of bridges, and so perpendicularly cut as to endanger the safety of the whole superstructure. From what we have already said of nature, it will readily be perceived that occurrences of this kind arise from an oversight on the part of art to form safety pools of a sufficient depth above the piles and paving. For instance, if the elevation of the water on the upper side of the bridge is equal to 4 feet during the highest flood,

and if we farther suppose that we have the operation of the tide, and hence an increase of force equal to other 16 feet, then the depth of the pool above the piling would require to be upwards of 20 feet—supposing the stability of a suitable *wear* below good.

4°. The flowing of the greater of two rivers into the less is an expression liable to objection, especially when taken in connection with what was formerly advanced on rivers and their tributaries. The less, for instance, may be said to be the tributary of the greater, and therefore must necessarily flow into it, so that what was formerly said, *if sufficient*, has only now to be retold. The example before us, however, is of an exceptional character, for in the generality of cases the larger stream flows in the larger and deepest valley; but in this the reverse is the case—the less stream flows in the deepest and greatest valley—conditions which counterbalance the difference in the volumes of water, so that the phenomena exhibited at their confluence are somewhat different. In the former case the lower angle on the left bank of the intersecting stream was acted upon and worn away, forming a curve. The waters of the tributary, from being unable to penetrate beyond the centre of the other, were immediately deflected back to its left shore, and even into the mouth of its channel, wearing off the angle to an extent beyond the influence of the greater. But in the present case the greater stream marches right through the channel of the less, so to speak, and commences the work of excavation on the opposite side from which it enters. This work goes on until the counteracting agency of the deeper valley and less stream puts a stop to it, so to speak, by the formation of a curved channel into the direction of the less stream. Contrary to what was formerly the case, we have now the lower and left angle at the confluence of the two rivers defended, as it were, and even extended forwards beyond its legitimate place; while an opposite angle is formed by the excavation of the greater stream, but rounded away by the action of the less.

In examples of this kind, the broad category of facts will differ according to the character of the valley in which the less stream flows, and the materials of which it is constructed. In the case of rock, for instance, interposing, they will be very different from others where the subsoil is sand, clay, or suchlike materials. A pool, again, may be formed of such a depth at the confluence of the two rivers as to prevent the work of excavation on the right bank of the less, or at least confine it to a very narrow circle; and out of this pool the large stream may flow in the direction of the less.

5°. The operation of tides in rivers give rise to many interesting phenomena to farmers occupying lands reclaimed from them by embankments, and consequently under high-water level. The altitudes of spring-tides are by no means equal, nor the depth of floods; and when two extremes meet together, and play upon an imperfectly constructed embankment, results are often by no

means of the most cheering character. For several years, although the highest tide and flood may not approach the summit of the embankment, yet at the expiry of this period a tide and flood may meet, rolling their waters right over its top, inundating and destroying a vast amount of property. In such cases, after the waves have passed their former limits, and are fast bidding defiance to all opposition, the scene becomes painfully interesting in a twofold degree; for when some half-an-hour has to elapse before any change can be expected, or before the calculated time of high water, the eventful moments, on the one hand, are tediously slow in passing; while the progress of the swelling deluge, threatening to lay claim to every furrow which the industry of the husbandman has reclaimed from it, is fearfully rapid. Too much caution cannot be used in the construction of embankments and sluices, so as to counteract and avoid such catastrophes.

At low water, when the tide begins to flow, the first effect produced is not the damming back of the water in the river, as if with a sluice; for, owing to the specific gravity of salt water being the the greatest, it proceeds upwards under the other like a wedge, elevating it as it progresses onwards—and this is more particularly the case where the two liquids are not agitated by the roughness of the channel of the river and the tempestuous state of the ocean. When both flow smoothly, and meet together softly, so to speak, the fresh water, by its specific lightness, floats upon the surface of the other; so that, if the stream is a large one, it may extend in the form of a ridge upon the surface of the ocean for several miles from the shore—a result experienced at the mouth of every large river by seafaring people. After the tide, however, has proceeded up the river a short distance, it is impossible to prevent the disturbance of the two fluids, less or more, owing to the prevailing presence of those adverse currents which we have previously glanced at, so that the tidal work partakes as much of the character of damming back as wedging up, in the majority of cases. But, in either case, the surface phenomena exhibited are similar, for the motion of the water at the surface is entirely counteracted, as well as at the bottom, and is seen curling up, as it were, and rolling against the natural current of the stream like water from a sluice.

The motions of tidal waters in rivers are influenced in the same manner by the unequal breadth of channels, and differences of depth, as the waters of the rivers themselves are, and consequently the velocities and times of flowing and ebbing will be different accordingly.

6°. A river is influenced in a threefold manner by the atmosphere: *First*, The atmosphere, when in a state of rest, imposes a pressure upon its surface equal to the weight of a column of water of from 30 to 33 feet in height; and, consequently, in passing under this load, a certain amount of friction is experienced between the particles of water and air. *Second*, The velocity of the stream may

be either retarded or accelerated by wind, according to the direction in which it blows; and *third*, Its surface-waters, and generally its whole volume, may be agitated in such a manner as to retard its velocity.

First. Air and water, we may observe, are two fluids, differing only in constituent elements, and from their incoherent character, if we suppose the two in contact with each other, and in a state of rest, we cannot conceive motion communicated to the one without disturbing the rest of the other. We cannot, it is true, say that the weight of one body added to the weight of another body either accelerates or retards its velocity in gravitating directly to the centre of the earth; but when the sluice of a mill-dam is opened, and water at rest set in motion by the laws of gravity, the lower stratum of the atmosphere is not only disturbed along the surface of the effluent fluid, but the fall of the mill-lade is displaced. Now, as the water does not occupy a greater amount of space, comparatively speaking, than formerly, it necessarily follows that a quantity of air is poured into the dam equal in bulk to the quantity of water discharged—equal in bulk to the quantity of displaced air from the mill-lade; consequently a twofold commotion is communicated to the atmosphere, and the force applied to produce those atmospheric changes corresponds with the retardation of the velocity of the river.

Second. If motion is communicated to the atmosphere—as is the case under the hypothesis of wind—it necessarily follows, in accordance with the last paragraph, that motion must also be communicated to water when the two are in contact with each other; so that, if both flow in one direction, the velocity of the latter will be increased and the former extended, supposing the velocity of water to be less than the velocity of wind, which is always the case, comparatively speaking, and that, if the two are moving in opposite directions, the velocities of both will be retarded. Those living contiguous to large rivers, when the operation of wind is less counteracted by shelter, generally speaking, than on small ones, must be familiar with many examples illustrative of the conclusions at which we have just arrived. They are familiar, we say, on the one hand, both with the tailing back of the river during storms of wind when blowing directly against it, and with the swelling of the stream or "bringing down of the water," as it is generally termed, on the other hand, when the storm and stream come from the same point of the compass, so to speak. In either case we have the swelling of the stream; and this will be the more perceptible if there is a lake in its course, such as Loch Lomond, Loch Tay, or Loch Ness, or a large number of safety pools. The reason of this is, that always where the river leaves the lake or the pool, it forms an angle down an inclined plane of greater or less inclination; and consequently, when the wind is brought to bear upon it, the particles

of which it is formed, instead of leaving the lake as from a state of rest, leave it with a velocity corresponding to the force of the wind. The result of this is the lowering of the lake and pools by a greater discharge of water; hence the origin of the phrase of "bringing down the waters of the lake." If, on the other hand, the wind is beating directly against the stream, the surface of the lake and pools will consequently be elevated above their ordinary level; hence, again, the tailing back of the water at the upper end of the lake and pools.

The swelling of the river on such occasions is only momentary; for if the storm continues to rage for any length of time, it soon falls to its ordinary level; and however much it may have been swollen by the lowering of the lake and pools, when the storm subsides the lake and pools will fill to their ordinary elevation,—so that a consequent depression or lowering of the general volume of the stream will be experienced. In the case of tailing back, a similar but opposite result will be realised when the wind ceases to blow, or veers about from one point to another.

Third. When the particles of a stream are disturbed and agitated among one another, a vast amount of attrition and reaction is experienced, and consequent retardation of motion. The gentle ripple and rolling wave across the stream are examples of this kind. In the former case the operation of the zephyr breeze may be immaterial, and, comparatively speaking, unfelt by the flowing particles of the stream, but, in cases of the latter kind, results may be very different; for, in broad and shallow streams, the bottom of the channel is sometimes laid bare at certain points, and the stream, as it were, tossed from it when the hurricane drives right across, or rather into it, over the edge of the channel. The force of any blast, and the consequent effects produced, depends very much in this and every case upon the depth of the channel of the river above the surface of the water, the levelness of the adjoining lands, and the shelter afforded by woods. It is seldom that the channels of rivers are deep in champaign countries; but where such is the case, and when the blast sweeps unbroken for a considerable distance—as it sometimes does over meadows—to the brink of the channel, and when the lands on the opposite side are elevated rather than depressed, little effect may be produced. But, on the other hand, when the blast sweeps down an inclined plane unbroken into the stream, as it were, and when there is a proper vent upon the opposite side, the greatest effects may be produced: the stream during a hurricane may literally be convulsed into a foaming conflict of waves, contending among one another in the most reckless and violent manner in the work of destruction on the opposite shore. Almost as much, if not more, depends in such cases upon the vent which the blast has from the stream as its direct course into it. It is the free and uninterrupted motion of the

refluent blast which gives to the influent its unbroken and maximum force. The velocity and force of a current of air moving along the surface of the earth is analogous to the force of water in flowing in its channel. Now, as the latter is lost in the standing pool of water, so is the former counteracted by the standing pool of air, and little effect produced upon the river below when the safety pool of air is of sufficient depth. In the generality of cases, however, the blast of the storm is broken and irregular, from irregularities on the surface of the earth, and consequently has a tendency to lower the elevation of waves; for the oscillation of a wave is like the oscillation of a pendulum. A certain retarding effect or agency is experienced in the latter case, which would soon restore the pendulum to a state of rest, were it not that a certain power or weight is applied to counteract this agency; and this power must be equal and equally applied. So is it in the case of waves: an equal counteracting power must be equally applied, so as to keep them up to a certain elevation; and this power is the wind. Now, in the irregular blast, we have a diversity of vertical currents analogous to those which we have noticed in the bottom strata of the stream, moving with different velocities, and, from their elasticity and greater velocity, producing, as it were, a whipping impulse; so that, if the force of the first blast is required to maintain the equal altitude of waves in equal times, and if it is overtaken by a second blast, with twice, and often ten times its velocity, the top of the waves is whipped off, as it were, and tossed before it in a state of foam, while the force required to do so depresses the remainder with a greater velocity than that of the adjoining half wave with which it co-operates, and consequently part of it is thrown off in a state of foam also from its top when it rises.

From these observations, therefore, the manner in which the winds agitate the waters of the stream, and retard its velocity, must be pretty obvious. If a drop of water, for instance, moves down the stream in a straight line at a certain velocity, and if a blast of wind is brought to bear upon it at right angles to this line, we have the composition of two forces, and consequently the drop of water will be impelled into the resultant of the two. But, as we have seen, one of these forces is irregular and counterbalanced by the elevation of the waters of the stream into waves, producing reaction and oscillation, while the force of the other is somewhat different, and confined into a specific channel. The drop of water, therefore, neither moves directly down the stream in the natural line of its direction, nor in the resultant produced by that of the wind; for, since we have action and reaction, we have two sets of forces, so to speak, and consequently two resultants in which the drop of water moves — so that it vibrates in zig-zag diagonal lines down the stream when not tossed into foam, and, when in this state, its path is beset with a greater

number of perplexing difficulties, producing a greater amount of attrition and reaction with other drops—the channel of the stream and the atmosphere with which it comes in contact, and consequently it sustains a greater amount of retardation of velocity; and what is true of one drop of the stream is true of all the drops, according to the several paths which they describe.

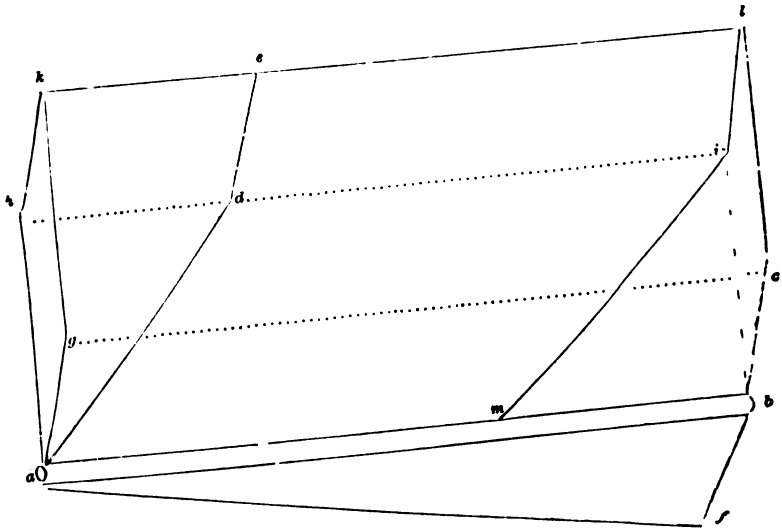
In our remarks on atmospheric influence we have been supposing the wind blowing directly *with*, *against*, or *across* the stream at right angles to its course, and consequently *this course in a straight line;* but in nature we find few examples of this kind. Let the wind, for instance, blow from any point of the compass directly across the river Forth at any point, and at other points very different results will be experienced. We have also been supposing, in the last paragraph, the velocities of water and wind such as to admit of waves upon the former; but in many instances the velocity of water is such as wholly to counteract the oscillation of waves. But although this is true, and although the particles of water are less agitated apparently to the eye, yet the space which a drop of water occupies while acted upon by any impulse of the wind in an instant of time is now very different from what it was in the other case—sufficient to counterbalance the difference; and, consequently, the amount of retardation is equal to the force applied as formerly.

We have thus taken a cursory view of some of the principal phenomena connected with rivers, illustrative of the motion of water in their channels, and the crookedly conflicting path which a drop of water traverses in passing from one point to another, in accordance with our definition of a drain. The channel of a river, however, forms but a part of the draining apparatus of a country, and is the least interesting part of the journey of a drop of water after it falls upon the field of the farmer to its final destination, the ocean; for, when once discharged into the river, it is beyond the reach of doing harm, generally speaking; but, until this is accomplished, it may prove itself the author of innumerable evils; and independent of this, the path which it traverses after it enters the surface of the field through the soil and subsoil is, if not equally crooked, at least equally conflicting—every inch of it being blindly disputed, as it were, by the advocates of deep and shallow draining. In tracing its footsteps, so to speak, therefore, which we now propose—that being the next head of our subject—we must look before us, in order, if possible, to thread the perplexing labyrinth of difficulties in which so many have failed to make a successful egress.

In discussing the subject of deep and shallow draining, and indeed the whole theory, two errors, we think, have generally been fallen into, one of which we shall notice in this place, and the other in a subsequent paragraph. In the first place, we think parties have generally grasped at more than they were able to con-

tain in their hands, and therefore, as a matter of course, always lost part of what they first caught hold of. If a shepherd, for instance, has more sheep in his walk than he can number, he may not miss one, oreven ten, out of his flock; and so long as he labours under the belief that he has the whole, he will argue accordingly. Under such circumstances, what is the value of his arguments even to those who know not whether he has lost a sheep or not, but who do know that he cannot number them? On the other hand, if he had only one sheep, he himself could be at no loss, while his arguments would obviously acquire a currency which under the previous hypothesis they could not. Now, in applying the principle which is here elicited to our subject, instead of grasping at whole clouds and showers of rain, let us be less ambitious, and content ourselves with one drop only, that we may not lose sight of it; whereas, if we grasp at the whole, ten to one but we lose sight of hundreds, and roughly abuse those who tell us of the fact, as theorists, into the bargain. To illustrate this doctrine further, before taking it up, let us for example take an experiment —a fine hair sieve containing an innumerable quantity of meshes or holes, not one of which is larger, nor so large, as an ordinary-sized drop of rain. Let us now put a drop of water on one of the small holes, and it will not pass through it; let us next put another on the top of the first, and then the first will pass through, but the two drops will remain in contact with the sieve, one on each side of the small hole. Let us again put a third drop upon the top of the second, and mark the result: the second now will pass through, when the first will drop from the bottom of the sieve; and if we add drop after drop to the upper side as fast as ever rain fell from the heavens, and drop after drop will fall from the lower side just as fast, but no faster, while two drops will always remain in contact with the mesh or hole. Now, if we suppose that we lose sight of the number of drops, we may differ as to the actual number; but a repetition of the experiment will satisfy us as to the soundness of the theory, and the dropping phenomenon of influx and efflux. Further, let us next pour a bucketful of water into the sieve, and then we will have exhibited a stream discharged from the under side of it. Now, in the experiment, where is the drainer who will argue from this fact that the water passed through the sieve in a stream undivided by the meshes or hairs of which its bottom is made? Lastly, let us pour water in bucketfuls upon the soil, and, however fast it may enter into it, we cannot suppose a volume of water flowing through the soil undivided: once divided by the solid materials of which the pôres of the soil is composed, it must remain so in those pores; and from the slowness with which it enters these, in the majority of instances, we cannot suppose that they are larger than the holes of the sieve. We have thus therefore in practice the subdivision of bucketfuls of water into drops; and why not therefore take up its theory, more

especially seeing that we have the largest quantity, or we may may say, comparatively speaking, the whole of the water falling upon the soil in drops. In short, we think the theory of a single drop of water, so to speak, a more simple theory than the theory of indefinite numbers, and the drain which removes it from the field more easily determined—and therefore we have chosen it; for if soils are equal in every respect as to porosity and constituent elements, if we can trace the footsteps of one drop from the point where it first enters the soil to the point where it makes its egress into the river, then we have a right to conclude that the paths of other drops, subject to the same laws and equally affected in every respect, will be similar to it.



1°. In our observations on the classification of soils in a former article, we remarked that some porous soils are naturally dry, owing to the subsoil. In such cases, if a drop of water falls upon the surface of a field, it will either be absorbed by the soil, or, if the soil has already absorbed its maximum of water, will percolate perpendicularly to the open substrata, by which it may be removed to the surface at some other point where it finds a vent. In such a case we may observe, in general terms, that the course which the drop of water describes may be in two or more directions—first, perpendicularly, according to hypothesis; and second, horizontally down one inclined plane, or a system of them. The former is too obvious to require further illustration, and the latter we shall afterwards have occasion to exemplify. In the meantime we may observe, that it may not unaptly be said that the path which it does describe to the centre of the earth is immaterial to the

drainer until it arrives at something like four feet from the surface.

2°. Let *b* in the accompanying diagram be any point at which the drop of water has arrived upon an impervious subsoil *b a f*, and upon this subsoil let *g l* be a rectangular field of pervious soil of equal texture, and of any length, *g c*, but of a fixed and uniform depth, *b c*, of four feet. Let *g k l c* be the surface stratum, and *a h i b* the bottom stratum parallel to the other, and in one plane with the bottom end of *a h* resting, as it were, on the plane of the horizon *a f*, consequently the angle *b a f* will be the angle of inclination of the field. Under such an hypothesis, we now propose to determine the direction of the drop of water at *b*.

The drop of water in this case, according to our hypothesis, it will be observed, is in motion; and the moving power or force, we may farther observe, is gravity, which, although acting perpendicularly in the direction *b f*, and in one plane, has also been communicated along the impervious stratum or inclined plane *b a*. The manner in which this force or power is applied we shall yet postpone to a subsequent article; what we wish to find at present is the direction of motion. Now, according to the laws of motion, there is but one line of direction which it is possible for the drop of water to take, and that line is from the point *b* to the point *a*, or the line *b a*, because it makes the greatest angle of declination on the plane. This, it may be observed, is susceptible of mathematical proof, which we shall endeavour subsequently to advance, when the proposition will be somewhat differently given.

Now, such being the direction of the motion of one drop at *b*, we are authorised to suppose that any number of drops along the line *i b* will move in lines parallel to it. The line of direction at *i*, for instance, will be *i h*, and so on for every intervening line, forming, as it were, a bottom stratum of tubes; and, further, we may suppose any definite number of horizontal strata of tubes passing through the vertical sections or planes *b c l i* and *a g k h* parallel to each other.

3°. In the above example we have supposed the bottom supply of water, or the drop of water, not springing or rising up from the bottom. Although this expression is generally used—an expression liable to objection in the majority of cases, when it is applied as in the example in question—the drop of water does not rise to the surface, but descends to the surface; and in other cases the surface may be said to decline to it, when it flows in a comparatively level direction. There are examples, however, where the water does rise to the surface; and if we suppose the line *b f* a crack or fissure in the impervious subsoil, which may be clay or rock, then a drop of water may ascend up it by the laws of fluids, when the direction of motion above the point *b* will be readily understood from that noticed.

4°. Instead of a bottom supply of water, let us now take a

surface supply, with a pervious soil 4 feet in depth, upon an impervious subsoil, with the whole of the data in reference to the diagram the same as before. We have now to determine the direction of the motion of a drop of rain when it falls upon the point *c*, which, according to the first and second articles, will be *c b a*, and parallel to its course will be the directions of any number of drops which fall upon the line *c l*.

In this example, however, what is true of the first drop which falls on the point *c* may not be true of all the drops which fall upon the line *c g*—for $c\,g \times c\,l$ is greater than $b\,c \times c\,l$; and consequently, if the number of rain-drops are equal to the number of percolating tubes, and falling as fast as they can receive them, part of the water must flow upon the surface. It is seldom, however, that the latter hypothesis is true; for in the majority of examples, in this class of soils, the surface porosity is capable of receiving much more than the heaviest shower of rain, when there is a vent below; and in many cases the lower strata of such soils, from the absence of vegetable matter, is opener, and capable of passing through their pores probably ten times, if not a hundred, of what falls upon equal areas of the sections of tubes of the surface stratum. The examples here, however, are so many, that we cannot at present do justice to them, and the whole of the phenomena involved will be exemplified in the following cases, taken in connection with the previous ones.

5°. So much for the direction of motion, and the line of the natural drain which removes water from one point to another prior to the interposition of art. Let us now involve the labours of the farmer, and we will find phenomena perhaps more complicated, and the drop of water less easily traced, but, at the same time, its footsteps no less evident on that account. For this purpose let us first suppose an open cut made across the bottom of the field, to the depth of *a h*, which will give full vent to the horizontal tubes in the direction *b a*, and introduce the theory of velocity in all its varieties—uniform, accelerated, and retarded.

In practice we invariably find, on soils of this class, that an open cut or ditch across the bottom, as we have supposed, renders a wedge-shaped piece of the field immediately above it comparatively dry. It drains it, in short. The upper side of the ditch forms the back of the wedge, which diminishes in depth as we proceed up the field, until it tapers to an edge, as it were. On the surface the water may be flowing at *e*, immediately above the edge of the wedge, while at *h* the depth of its back may be half the depth of the ditch. Now, it is very evident, from a vertical section of the field at *e* being equal to the section *g h*—the number of tubes in each being equal also—that if half the latter discharge as much as the whole of the former, the velocity of the affluent fluid must be double; but in the case of rain, the quantity which falls below *e* will be equal to, greater, or less, according to the length of the wedge or drained

soil, than that which falls above it; consequently the velocity will be greater accordingly.

We have in this case obviously interesting facts brought before us to be accounted for; and this can only be satisfactorily done by tracing a drop of water from the surface where it enters to the point where it makes its egress. In noticing the velocity of water in rivers, when accelerated by flowing down greater inclinations, we observed that the areas of sections, and number of particles in those areas, were different at the top of the plane from what they were at its bottom, and that this arose from difference of speed and altitudinal pressure. In this case, although a drop of water is subject to the same laws, yet it is counteracted by the interposition of the soil at rest, and therefore we cannot suppose that it issues from the soil into the ditch with a velocity equal to what it would have acquired in falling freely from the upper angle of the back of the wedge to its lower angle; but when we see the length of the wedge or drained soil equal at both sides of the field, and the depth of the back of the wedge at the ditch equal along the whole breadth of the field also, then we can conclude that velocities are equal in equal soils of equal inclinations, and that this velocity will be indicated by the length and depth of the wedge, so that theoretical data can be determined by a single experiment for many soils suitable for practice.

With these preliminary observations of the existence of facts and obvious deductions, let us now endeavour to point out the manner in which a drop of water acquires this increase of velocity, comparatively speaking, as formerly proposed, so as to account for the draining of the wedge-shaped portion of soil adjoining the ditch at the bottom of the field.

We have already observed that the moving power was gravity, and that its direction was perpendicular to *a f*, and also that the pressure of water was equal in every direction. The water, therefore, in the different strata of tubes, exercises a vertical and horizontal pressure, so that if a drop falls at the point *c*, it will act in the direction *c b* from its own weight, and in the direction of *c g*, produced by the pressure of the next drop in the tube *c g* immediately above or adjoining it in the direction of *c*. Now, the first effect produced on the equilibrium of the acting forces here by the opening of the cut will be the removal of the horizontal resistance experienced in passing through the soil beyond *g a*; the outside drop is pressed upon, but has nothing to press in this direction, so that the downward pressure of the first row of drops will force the second row forward with a greater velocity, and so on for every stratum of tubes downward, until the horizontal velocity acquired is sufficient to counterbalance the downward pressure. Now, as the pressure is as the height, and the resistance as the length, it consequently follows that, as we proceed up the field, the resistance or friction experienced in passing through the tubes will increase,

and the point of equilibrium arise, which point will pass along the under side of the wedge or dried ground.

In the above example we have supposed the whole water a bottom supply; but the only difference, in the event of rain, would be a less portion of soil drained. If, in the absence of bottom water altogether, a drop of rain falls at *c*, it will percolate to *b*, as formerly noticed; and if a second drop follows it in its path, it will overtake it at the bottom, and force the first through a pore of the soil towards *a*, in the same manner as the second drop of water in the experiment of the sieve forced the first through the small hole, and every succeeding vertical drop which follows would urge forward the horizontal drops another drop's breadth, and so on until the first drop made its egress at the point *a* into the ditch. This hypothesis, however, it will be observed, although it illustrates more conspicuously the manner in which a drop of water is urged forward than its opposite, can only be true in the event of no rain falling upon any other part of the field; for when rain falls upon the whole field, the first drop which issues into the ditch is the drop which falls at *g*; for as it will be at *a* as soon as the other is at *b*, the second drop which falls upon it will drive it at one impulse into the ditch. From these extremes the intervening phenomena may be gathered.

6°. The above example illustrates the old system of draining by open ditches around the field, and where the effects produced by the side and top ditches have not been noticed. In many cases the bottom ditch of one field forms the top one of another, so that this was in some measure unnecessary. Independent of this, however, we must observe that our object is not to comprehend a whole system of draining, but a certain class of facts connected with one drain. In furtherance of this object, let us now introduce the modern system of draining at some 16 feet asunder, and suppose that the diagram, instead of representing the whole field, shall now only represent one-half of a ridge, with an artificial drain, *a b*, 4 feet below the surface, put into its centre, according to a former hypothesis; and let us also suppose, in the first place, a bottom supply of water.

In this case, any drop of water at *i*, in the bottom stratum, will not be removed from the soil by the drain *a b*, but descend in the line *i h*, and all the drops in the line between *i* and *b* will percolate parallel to it along the bottom plane unaffected by the artificial drain.

We might here repeat what we said on the second article relative to mathematical demonstration; but before we could successfully introduce such, a long list of axioms, definitions, &c. would have to be given, and these we must defer. What we wish to enforce upon the attention of our readers is the fact, that the question is a mathematical one, and that the science of draining involves the science of mathematics to a much larger extent

than writers on the subject have imagined—the *second* error to which we formerly alluded. The truth of this conclusion, however censurable it may appear in the eyes of some, will appear the more evident the further we advance in the discussion of the subject.

The truth of the proposition before us is obvious from the 2° section; for, according to it, any drop at *i* will percolate in the direction *i h*, and so forth as to the others.

7°. Before the drop of water at *i* will percolate along any diagonal *i m*, the angle of declination which it makes with the horizon must be greater than that which *h i* makes. We might have given the proposition in different terms, but give it in these, as being perhaps the more obvious of the two.

By the 5° section it is shown that the drop of water, in moving along the bottom plane in the direction *i h*, is acted on by two forces, but in one vertical plane—the one perpendicularly by gravity, and the other by the weight of a second drop or drops of water, in the percolating tube *i l*, urging it forwards along the plane *i h*. To these forces, therefore, we must find composants before the drop of water will move in the resultant *i m*. Now, the mere depth of soil above the drop at *i*, and along the diagonal *i m* and the artificial drain *a b*, will not produce that composition of forces required to remove the drop from the point *i* to the point *m*; for it matters not what the depth of the soil is above the drain: a certain angle having been obtained in the one case, a certain angle must of necessity be obtained in the other.

8°. Again, supposing that composants have been found, and that *i m* is the resultant: then we may suppose that a drop of water will acquire equal velocities under certain circumstances at the point *m* in descending the inclined planes *b m* and *i m*, supposing the points *b* and *i* on a level; but we cannot suppose a drop of water will pass over those planes in equal times, for the times are all as the length of the planes.

9°. Again, supposing the soil to be as open as a *chaff-riddle*, we can suppose that a drop of water will acquire an accelerated velocity in descending from *l* to *i*, and consequently distances between drops increase with the increase of velocity in passing over different spaces; but we cannot on that account suppose that more drops pass the point *i*, in any instant of time, than pass *l*, or enter the mouth of the tube in an equal instant of time, for that would be to suppose that distances did not increase between drops, and that more drops were discharged from the tube than entered into it, which is absurd.

10°. We cannot suppose the hydrostatic pressure of a column of water in the percolating tube *l i* equal to its length, so as to produce accelerated velocity, for that would be to suppose a contradiction; for fewer drops must pass *i* than enter at *l* before a close column of drops can be obtained.

11°. We can suppose that the depth of the artificial drain (*i. e. its diameter*) is such as to be insufficient to remove the whole of the water from the percolating tubes; but this is only supposing that a drop of water at *i*, and indeed all the drops of water in the vertical plane *l i h k*, are not disturbed by art, but allowed to flow in their natural directions, according to section 2°, to the bottom of the field—a hypothesis but too frequently realised in practice.

12°. Again, we cannot suppose percolating tubes and artificial drains, equal in every respect as to inclination, construction, and capacity, to discharge different quantities of water, supplies being also equal; for that would be to suppose that the *hair* sieve would discharge more water than the chaff-riddle.

13°. Lastly, on *chaff-riddle soils* we cannot suppose, let the supply be from clouds, buckets, or otherwise, that greater quantities of water will pass through one thousand chaff-riddles in equal or less time than will pass through only one chaff-riddle.

14°. Hence the obvious conclusion, that even on soils of this class there is a limit to the length of any diagonal, *i m*, which determines the distances between drains.

15°. In ninety-nine cases out of every hundred, instead of accelerated motion in percolating tubes, we have uniform and retarded; and, owing to the resistance of the atmosphere, which has always to be expelled, the majority of examples exhibit retarded motion in individual tubes, or, what is the same thing, the velocity of a drop of water is retarded. This is obvious from the fact of three drops being required to press one through a hole of a hair-sieve; and if we now substitute *hair-sieve soils* for *chaff-riddle soils*, we will arrive at conclusions more important than that in the last section, viz.,

16°. That, contrary to the generally received opinion, the distances between drains must be inversely as the distances above them. In other words, the longer we make the common lengths or vertical distances, *l i* and *c b*, above the diagonals, (and there are not two vertical tubes above any one diagonal of equal lengths,) so much the shorter must we make these diagonals.

The truth of this proposition, *however disputed*, is obvious, for we think it takes no great stretch of the mind to perceive that *l i* + *i m* is greater than *i m* added to the one-half of *l i*, and consequently (by section 13°) will discharge less water.

17°. It may be said that, seeing the whole of the water which falls upon the surface, an area of 18 feet by its length, passes into the circumference of the artificial drain, an area of about *one twenty-fourth* of the size, supposing the circumference to be 9 inches; and this is leaving out of consideration the fact, that pipes are seldom more than 2 inches in diameter, and that water only gets into them at the joints between them—that therefore the velocity of a drop of water at the pipe must be greater than at the surface,

(by section 5°.) But the two examples have no connection with each other; for, in the 5° section, the soil above the wedge was full of water; *air was excluded*—a most important difference in draining; whereas, in the present case, air is only excluded, and partially excluded or more excluded, if the pipe is of a sufficient size at the pipe then at the surface, while at the surface, in the majority of cases, fewer tubes are occupied by the water and more by the air, because of the difference in the density, elasticity, and force of gravity.

18°. If we take an example of capillary soils, attention to the 16° section will be found more necessary to be observed in practice than on pervious soils. We ourselves, with an experience as extensive and varied as many, have always found it to be so; and we cannot help thinking that almost all the *penny-wise attempts* to drain soils, which have proved themselves abortive, have arisen from inattention to it.

In the diagram, let *f b c* be a capillary tube. Then a drain, *a b*, cutting that tube, will not remove a drop of water from the tube *b f*, much less from the tube *i l;* for, according to the law of motion in capillary tubes, a drop of water will not ascend to their tops. Hence the fallacy of our *bleeding dogmas* and lip-labour philosophy. This is perhaps dealing briefly with this fine carpet theory of putting the finger gently but firmly upon the capillary vein, and just lancing it four feet below the surface, seeing the number and respectability of those who have embraced it; but our limits are now evidently calling upon us to be brief, and to come, in conclusion, to the important question—the depth of the farmer's drain. And perhaps we should here apologise for the length of this introductory ramble to it; but deferring the solution of this last proposition, and our reasons for beginning at the far end of our subject to a "*more convenient season*," we at once observe, that

19°. The "depth" of the farmer's drain, *c b*, is part of its length, so to speak; for *a b* + *b c* is the whole length of the drain which removes a drop of water from the point *c* to the point *a*, according to our definition of a drain. If this is not strictly mathematical, it partakes, at all events, something of the *common-sense character* which some appear to prefer. Had we been squabbling about *the depth of a cow's tail* all this while, some of our Cockney salesmen or drovers, a race by no means the most intelligent, would obviously have stepped forward and solved the problem; and, from the analogy of the two solutions, we are doubtful whether they or we are entitled to lay claim to the greatest share of merit. After all, in looking back upon the river and its tributaries, the artificial drain and its tributaries, we must conclude that the path which a drop of water has traversed, from the surface of the farmer's field to the ocean, is by no means a straight journey.

THE FARMERS' NOTE-BOOK.—No. XXXII.

*Johnston's Notes on North America.**—The faint old plough-marks which the hunter meets with on our lone Highland hills, far up on their desert slopes, hundreds of feet above the present zone of cultivation, and which seem so strange and preternatural that the peasants name them the Elfin Furrows, are not less remarkable in the eyes of the thoughtful traveller as the mouldering remains of an industrious but long-forgotten civilisation. Let us hope that the plough will again revisit those lone places; that the tide of cultivation, after its long low ebb, will again flow upward to its old marks; that the yellow corn may once more displace the barren lustre of the purple heath, and the lone domain of the gor-cock become the residence of happy and industrious man.†

This desirable period may not be so distant as to some it appears. Within the last quarter of a century, what has not Agriculture done among us? and how little has it merited—nay, how triumphantly has it falsified, the taunts of its selfish defamers! To speak of nothing else, what skill and what energy have been displayed in procuring for our poor soils the elements of fertility! They who talk of farmers ever sticking like limpets to the rock—ever clinging obstinately to old ways, old prejudices, while the world around them is hasting on faster and faster—talk so from very ignorance. They forget the many great changes in farming that this century has witnessed. They forget the revolution in agriculture that was necessary ere the very first step in manuring was generally accomplished—the planting of green crops, the buying of live stock, the building of sheds and courts and byres, and the subsequent thousand and one experiments in feeding. But as agriculture advanced, the difficulty increased. Each year brought new demands on behalf of the hard-tasked soil, and the manures of the farmyard were soon found inadequate to meet them. Let us see what followed—it will show whether farmers be indeed the stand-still dunces which some men have not scrupled to call them.

First of all, bone-dust was found to be an excellent fertiliser; and forthwith bone-mills were erected, and the osseous gatherings

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* *Notes on North America; Agricultural, Economical, and Social.* By James F. W. Johnston. 2 vols. post 8vo. Blackwood and Sons, Edinburgh and London. 1851.

† Among many interesting evidences of the former fertility and populousness of the now barren wilds of Scotland, take the following, from Mr Wilson's recent work on the *Archæology and Prehistoric Annals of Scotland*:—"About four miles inland, on the north side of the Cromarty Firth, is a moor which the proprietor is reclaiming from the wild waste, and restoring once more to the profitable service of man. In the progress of this good work, abundant evidence demonstrated the fact, that the same area from which the accumulated vegetable moss of many centuries is now being removed, had formed *the scene of a busy, intelligent, and industrious population*, ere the first growth of this barren produce indicated its abandonment to solitude and sterility."—p. 224.

of town and country were poured into them, in order to eke out the refuse of the byre. Nay, wide Europe was ransacked for this new and potent agent of fertility; the fields of the Continent were robbed of their long-buried stores to grow the grain of England. The scenes of unforgotten strife, where the grass still grew rank and long, were opened for the sake of their hidden treasures, and "a valley of dry bones" would then have been prized like a golden mine. Leipsic, Waterloo, and far Borodino; Eylau, Lutzen, and Friedland, and many another bloody field of fight, were thus ransacked; and not seldom did our wondering millers lift from amid the bone-heaps fragments of shivered swords and rusty breastplates.*

But even the hundred battle-fields of Napoleon failed at length to yield an adequate supply. Bone-mills began to stand idle, and yet the ground clamoured loudly for more. Farmers were puzzled what to do, but cast their eyes anxiously around to discover some other agent of fertility. And lo! it was found almost at the Antipodes—upon the lone islets of the Southern seas, amid the rainless region of Peru, and off the burning shores of Africa,—where countless flocks of sea-birds had for ages made their resting-place. The discovery was a godsend, and the news spread like wildfire. Ship after ship sailed for those far-off islets, and returned laden with guano, to add still further to the produce of our fields.†

Guano in turn grew scarce, yet the progressive movement went on. Town and country were ransacked at home, as eagerly as land and sea abroad; and soon a rich, though limited, mine of manure was discovered in the beds of coprolites, which pass like verdant zones across many parts of England. The farmer's eye first rested reflectively on the superior luxuriance of these bands, and, with the eagerness of the gold-seeker, he dug into their depths to lay bare the cause. In those depths he found strangely-formed nodules, the fossil-dung of enormous lizards or crocodiles which in primeval ages had roamed over the south-eastern parts of our island; and the value of the discovery became at once apparent when analysis proved these coprolites to contain a much larger quantity of phosphoric acid than the best bones.

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* England consumes more bones, for agricultural purposes, than all the rest of the world. As bones gathered for this purpose in Great Britain are free from police or excise inspection, we have no means of ascertaining the amount of the home supply; but the *official* value of those imported amounted, some twelve years ago, to £300,000 per annum, and the selling price to our farmers would probably be little under £400,000. Since then, the foreign supply has been decreasing; the bones imported in 1848 being worth, in bone-dust at 2s. 6d. per bushel, about £220,000.

† The imports of guano rose from 2000 tons in 1841, to 220,000 tons in 1845; but, since then, the paucity of the supply has caused the average annual importation to fall to about 90,000 tons. It will give some idea of the energy and enterprise of our farmers to state that, as the price of guano has ranged from £6 to £10 per ton, the money expended on the purchase of this manure *alone* amounted in 1845 to the enormous sum of a *million and a half sterling*.

Meanwhile Science was working away in her laboratory to assist the sturdy farmer in the field; and not a little was he benefited by her investigations. Nitrate of soda, sulphate of ammonia, and a dozen other chemical fertilisers, were thus added to his store. The fertilising property and rapid action of bones were greatly enhanced by dissolving, or rather digesting, them in diluted sulphuric acid.* Soot, the refuse of the manufactories of glue, soap, gas, &c., were no longer wasted, but became of value to their owners, and still more to the farmers who bought them; while water-meadows, and the important science of Irrigation, became studied and applied.

To crown all,—and as if the wealth and enterprise of England made her in truth the world's Queen, and supplied her necessities by tribute from every clime,—last year an "animal manure" began to be forwarded to us from Buenos Ayres. The countless herds that overspread the Brazilian Pampas used formerly to be slaughtered solely for the sake of their hides. But time and experience teach wisdom: the tallow and the best part of the flesh are now saved for use, and the remaining mass of dry flesh and bones is being exported as a manure. This animal matter has been found, in theoretical value, to be "nearer to guano than to any other manure," and superior to it in regard to the gradual liberation of ammonia; and doubtless it may now be regarded as a standard auxiliary to the agriculture of our islands.

It was no ordinary demand that produced so extraordinary a supply. It was no ordinary demand that brought guano from the isles of the far South—bones from every battle-field in Europe — animal manure from the Pampas of Brazil — that revealed the coprolites in their hidden beds—and that set the chemist devotedly prying into subjects and substances hitherto totally foreign to his researches. And it is at once cheering and instructive to mark the result — to see how, as one fertilising substance grew scarce, the skill of the agriculturist discovered new ones at hand, or how his energy and enterprise caused others to be brought to him from afar. The same process is continuing, and we hope ever will continue; the same progressive demand is going on, and we hope it will ever meet with the same ready supply. But in order to insure this, knowledge and enterprise must progress in a like ratio; and ever more and more must Agriculture be aided by the counsels of Science. So that every man of science—be he chemist, mecha-

* It is worth while noting here, that although, from the pasty state in which sulphuric acid leaves them, the bones must be mixed with some other substance (such as ashes or soil) before it is possible to apply them by either the hand or drill-machine; yet that unfortunately it is too often the case that some substance containing lime (such as chalk or gypsum) is used for this purpose, which—instead of leaving a mixture containing from twenty to thirty per cent of soluble phosphate of lime—at once restores the bones to their original insoluble condition.

nist, or physiologist—who brings his knowledge to the aid of the farmer, becomes at once to him an able coadjutor and especial benefactor.

Foremost among such men we must at present reckon the talented Professor of Chemistry and Mineralogy in the University of Durham. By his admirable *Lectures* and other works, which have obtained for him a more than European reputation—as well as by his instructive analyses while chemist to our Chemistry Association, and by his general zeal for the improvement of agriculture, he has won for himself a name that will not soon be forgotten by the farmers of Britain. His recent work on North America—which, we may mention, is as valuable for its political and philosophic reflections as for its agricultural information—has given him a fresh title to our gratitude. For he has therein given to the public a carefully-written eye-witness account of the present state and future capabilities of our North American provinces—a thing now much needed; and so clear and so minute are his descriptions of the local features of these provinces, and of some portions of the States also, that an emigrant may almost fix, ere ever he leave our shores, on the very farm he purposes to take.

His volumes are so full of information interesting to agriculturists that it is impossible to do justice to them in a single no[illegible]—we shall, therefore, recur to the subject in a future number. Meanwhile let us open our present review by acknowledging a service he has done this country during his recent visit to America. We all know that good guano is exorbitant in price, which, like our other fertilisers, prevents it from satisfying the wants of the farmers, and that consequently they must soon be compelled either to treat their land less generously, or else discover, yet again, some additional fertiliser. Professor Johnston has done the latter. In the course of his travels, he observed many beds and rocks of gypsum and phosphate of lime; and he not only endeavoured to instruct the Americans in the value of these rocks to their own agriculture, but suggested that they would find it profitable to export the latter of these substances to England. His advice has been acted upon; the first consignments have reached Liverpool; and thus a new and valuable supply of fertilising matter is being opened up to us. The quantity of phosphate of lime existing in the Northern provinces of America is still very imperfectly known; but from the synopsis of Professor Johnston's observations on the *Lime-Rocks* of these regions, it will be seen to be considerable, and that investigation seems all that is required to reveal the precious mineral in great abundance.

We believe there is scarcely a cultivated corner of New Brunswick which Mr Johnston did not visit; and the first place where he mentions the occurrence of gypsum-rocks is near the well-built little town of Windsor, standing on the estuary of the Avon, and

within a short distance of the mouth of the St Croix River. Both of these rivers, which empty themselves into the Bay of Minas, are distinguished by the lofty white cliffs of gypsum which appear at various places along their banks. The country adjoining the lower part of their course is in many places gypsiferous; and the undulating appearance of its surface, the rounded hills, and the sudden hollows which here and there appear, are chiefly to be ascribed to the numerous swallow-holes and sinkings which have been produced by the gradual solution and removal, by surface-water or by springs, of the gypsum from beneath. In this neighbourhood is the plaster-quarry of the well-known Judge Haliburton, which supplies the principal article of export from the river Avon. The gypsum here occurs, and is worked very much as our limestones are,—forming a face of rock in which different layers are visible, of various degrees of whiteness and crystalline structure. The whitest and purest is quarried, and conveyed by an economical railway to the river, where it is shipped chiefly for the United States. A somewhat similar traffic is carried on at L'Etang Harbour, on the Bay of Fundy, where lime is burned in considerable quantities for export to Boston; about a cord of wood being used for each ton of lime. The rock here is blue (occasionally, where trap-veins touch it, whitish and crystalline) limestone,—in thin beds interstratified with metamorphic clay-slate, and in thick layers of twenty or thirty feet, forming distinct rocky elevations, which are seen to run inland for a considerable distance. The strata are nearly vertical, and the limestone without fossils.

But the gypsum-rock presents a still more remarkable appearance on the banks of the Trout Brook, which joins the Salmon River in the Vale of Sussex. The quarries occur in the woods, at a short distance from the highway; and at several localities near Amherst, also, he says, there are "cliffs of gypsum which present this mineral in exhaustless abundance." In fact, the whole province of New Brunswick seems to abound with this valuable agent of fertility.

Though gypsum is here so abundant, it has not been much used for agricultural purposes. Of two farmers with whom Professor Johnston conversed on this subject, one had tried it without effect, the other with marked benefit to oats and grass—it bringing up among the grass a crop of clover, where none had ever been seen before. The Professor adds that, in western New York, a hot dry summer is considered most favourable for the beneficial action of this mineral substance; and suggests that this may have been the character of the season when it succeeded with the one, and not so when it failed with the other, of these experiments. "The fact of young and old trees growing with their roots fixed in and upon the pure soft gypsum-rock, proves at least that it is unlikely, even when present in large quantities in

the soil, to do material injury to vegetation." Yet it might be useful, he adds, to try which of our cultivated plants will, and which will not, grow well under such circumstances.

It is recorded of Benjamin Franklin—who, eminently practical in his cast of mind, was certainly one of the greatest benefactors America has yet had—that, desirous of attracting the notice of his countrymen to the valuable properties of gypsum, he applied, in the middle of an ordinarily treated field, a quantity of this fertiliser in the form of the letters GYPSUM, in order that passers-by might have ocular demonstration of its excellence. This happy conceit does not seem to have been attended with the success it deserved; yet it will immediately be seen that the New Brunswickers are even behind the Yankees in this respect.

Red marls, with vast deposits of gypsum, occur within a few miles of the shores of Shepody Bay; and for ten or twelve miles up a stream which falls into the bay at Cape Demoiselles, there are found cliffs of gypsum eighty to a hundred feet high. Nevertheless, says Professor Johnston—"It will surprise some of my readers, perhaps—while it will give them an idea of the abundance of this mineral substance, and the small estimation in which it is consequently held—to learn that the owner of one of the farms in which these cliffs occur was said to have sold the right of working, or his interest in the future mines of gypsum on his own land, for a barrel of flour! One of the purest white deposits of gypsum known in this neighbourhood is the property of a Yankee, who exports it to Eastport in Maine, there burns and crushes it, packs it into casks, and transmits it to the more southern States, and even back again to New Brunswick, whence the raw material is derived. The shipment to, and manufacture in Maine, is for the purpose of avoiding the heavy duty upon manufactured articles in the United States."

Our readers may derive some useful hints from the following paragraphs of Mr Johnston's work, which give the author's remarks on the beneficial action of this fertilising substance, and the mode of applying it adopted in the counties of western New York:—

Plaster or gypsum is extensively used in this neighbourhood, being almost the only manuring which a large portion of the land receives. It is obtained abundantly among the beds of the Onondaga salt-group, and is applied in the unburned state. It is crushed in mills, where it is sold in the state of powder at 3d. a bushel, or a dollar and a half a ton of 25 bushels.

The maize is plastered either once broadcast, at the rate of 3 bushels an acre, or twice with the hand, upon each hill after each hoeing, at the rate of 1 bushel an acre. I saw four rows in the fine field of Indian corn I walked through which had not been plastered, while all the rest had—once only at the rate of a bushel an acre; and the difference in favour of the plastered part was very striking to the eye. Oats are also much benefited by plaster, especially in a dry season like this; and it brings away clover, and makes it very tall. It is likewise believed to improve the potatoes which are planted without manure. I caused a number of plants of the potatoes to which gypsum had and had not been applied to be dug up, and certainly the number and size of the potatoes found at the roots, as well as the

height of the stems, were greatly in favour of the plastered part. It was applied before hoeing, and then drawn up around them. It is usual to put it in with the sets; but it was put around the young plants this year, "only because," said Mr Geddes, "the drought was such that I saw if something was not done I should have no crop at all." An English farmer would hardly believe he had done anything towards saving a crop of potatoes if he had only sprinkled a bushel of gypsum over an acre of the land in which his potatoes were growing.

This beneficial action of gypsum, notwithstanding all that has been written upon the subject, is still very wonderful, and not the less so that in so many places, and in so many circumstances, it fails to produce any sensible effect. Mr Ruffin states, that in the Carolinas it is found to produce the best effects upon land which has been already limed; and here, where its beneficial influence is so manifest, the land is naturally rich in lime. I have caused an analysis of a portion of the green shale from which the soil on Mr Geddes's farm is formed to be subsequently made, and have found it to contain as much as 23 per cent of carbonate of lime, and 13 per cent of carbonate of magnesia. It may be, therefore, that while this marly and magnesian character of its soil certainly makes the district more favourable to the growth of wheat, that it has some influence also in disposing it to be beneficially acted upon by gypsum. This substance does not appear to require rain to aid its effects, since it is applied especially in droughty seasons. A calcareous soil and a hot sun may possibly, therefore, be instrumental towards its success.

This view is further supported by the prevalent opinion among farmers "that the great use of plaster is *to draw water from the air*;" which means, as I take it, that its action is more apparent in dry than in wet seasons. A very extreme view of its influence upon the weather was entertained by some of the old Dutch farmers in the United States—one of whom, according to Judge Peters, objected to the use of it because "*it attracted thunder.*"

But by far the largest and most valuable stores of mineral manure are to be found in Canada and northern New York, where they exist in the shape of metamorphic limestone, *unusually rich in phosphate of lime.* Interstratified with porphyritic and syenitic gneiss, this ridge of rocks extends, as a prolonged highland, in a north-east and south-west direction, from the west of Labrador to the Ottawa—running nearly parallel to the St Lawrence, at a distance of ten or twelve miles to the north of it. Near Bytown, on the Ottawa, the limestone appears in great force; and from that point the ridge of mixed rocks ranges nearly due west to the shores of Lake Huron. But near the point where it crosses the Ottawa, a branch of this valuable formation forks off towards the south, spreads over a considerable extent of country between the Ottawa and the head of the St Lawrence, crosses the latter river at the Thousand Isles, and passes into the northern counties of New York, where it is extensively developed—principally in the state of white marble, but still rich in the phosphate.

This rock contains imbedded in it various simple minerals in greater or less quantity; and among these *apatite*, or phosphate of lime in grains and green crystals. Mr Logan, geologist for the Canadas, mentions several localities where this mineral phosphate is especially plentiful; and Mr Hunt, chemist to the survey, affirms that in some places it forms a tenth part of the whole rock. "Such a limestone rock," says Professor Johnston, "in most easily accessible parts of Great Britain, would be as sure a source of permanent wealth as a mine of Californian gold." One economical fact is certain—it is of great value to the neighbourhood in

which it exists, where it can be readily quarried and burned for lime, to be used in agriculture; and upon the exhausted wheat-soils of Canada, when properly prepared and applied, its use would be invaluable. An inquiry into this point is deserving of the attention of the Canadian Legislature, with a view to the good of the province,—and of individual landowners along the outcrop of this rock, with a view to their own individual profit. To the United States the discovery will be not less valuable. For as soon as American farmers have satisfied themselves that, when prepared by means of sulphuric acid, it is really useful to their crops, it will come into general use, and may thus revive the wheat-growing powers of New England, and enable western New York to compete more profitably in the wheat-market with the new States of the North-west.

It is needless to comment upon the importance of the subject we have thus laid before our readers. A new manure brought within our reach, especially one so valuable as phosphate of lime, would be at any time a great benefit; and it is especially so now, when our farmers are exposed to an oppressive competition with countries where labour and land are cheap, and taxes nominal. Professor Johnston has little doubt but that Canada also will be found rich in this mineral manure:—we hope its Legislature will lose no time in testing his anticipations by inquiry, and thus open up a profitable source of export for the provinces, and at once regenerate their own fields and those of their mother country.

The unlearned reader (says Mr Johnston in conclusion) may ask what use this substance is put to in England? It is found—when reduced to fine powder, and rendered soluble by means of sulphuric acid—to promote very much the growth of our turnip and other common crops. It is prepared and sold, therefore, in large quantities—thousands of tons every year—for this purpose; and, under the name of superphosphate of lime, is in much demand among improving farmers in many parts of the country. But it is as yet met with only in few localities, and generally much less pure than that which is likely to come from the United States, and, I hope, from Canada. These new supplies, therefore, will cheapen the article—bring a better quality of this manure into the market at a lower price—will thus place more fertilising means within the reach of the farmer—will keep down the rising price of guano by the beneficial competition—will benefit practical agriculture, and increase the produce of the country. To the United States the discovery will, in the mean time, afford a new article of export, new employment to a part of its people, and, I hope, a reasonable profit for their exertions to my friends who have sought out the several localities.

Of the *agriculture* of America there is little to be said—and, except warnings, nothing to be learned. In every respect it forms a remarkable contrast to that of China, which we lately reviewed. While economy of manure and permanent fertility of soil are everywhere witnessed among those "oldest of Tories," the plodding unspeculative inhabitants of the Celestial Kingdom, waste and exhaustion characterise the farming of the "go-ahead" people of the United States. Land is so cheap in America that it is more profitable to buy new farms than to manure the old; and thus the great wheat-region of the New World is ever retiring further and

further from the shores of the Atlantic. Secondly, it is more profitable to invest money in other businesses than in land, as farming yields on the average but five per cent, while the common rate of interest is two per cent higher. Thirdly, land-property is less sought after in America than in almost any other country:—(1) because unsuited to the migratory spirit of the people, and (2) because it attracts the jealousy and ill-will of the democrats, from the political influence supposed to be exercised by the landowner over his tenants. Fourthly and lastly, agriculture in America is impeded by the high price of labour, which renders farming on an extended scale unprofitable, and practically denies to the farmer any other aid than that of his own family. The bad effect on agriculture of the second and fourth of these causes is thus expressed by a practical farmer from Syracuse, in western New York:—

The results of my personal experience are, that money is not to be made by farming in this State. If a farmer hire *two* men, and work with them, and keep them at their work, he may maintain his family, and clear 8 per cent upon the value of his farm. But if he farm more largely, as a gentleman farmer, leaving the management to an overseer, he will not make more than perhaps 2 or 3 per cent. Farming is much less profitable in my county of Onondaga, during the last five years, than it used to be. Exhaustion has diminished the produce of wheat, formerly the great staple of the country. When the wheat fell off, barley, which at first yielded 50 or 60 bushels, was raised year after year, till the land fell away from this also, and became full of weeds. It still grows 50 bushels of Indian corn, and this is the best crop we now get—but it must be manured. Much is now laid down to grass to be recruited; but those who are anxious to make money are turning their hands to something else, and either selling or letting their farms. A farm in a good situation can be let to pay 5 per cent; but as 7 per cent is easy to be got for money, few persons care to continue the owners of farms which they cannot cultivate themselves, and can only let to yield a return like this."

A kind of listlessness creeps over the second and third generation of the Americans-born, both in the British provinces and in the States. And Mr Johnston remarks, that after an immigrant farmer and his sons have attained to competence, "the progress is not so rapid, and a man cannot himself, or through his sons, progress indefinitely in wealth and station as at home." The unprofitableness of farming on a large scale is assigned as the explanation of this remarkable fact by the people themselves; and this, "if true, satisfactorily enough accounts for the greater industry and energy of the poorest, and the slackened exertions of the better off. But is the unprofitableness of more extensive farming in America a necessary or unavoidable thing?" Our author does not definitely answer this question, nor shall we attempt to solve it.

The following are our author's "Notes" on the horses and cattle of the United States:—

In the New England States and in New York, the Devon blood prevails. Most of the stock are *grades*, as they are called, or crosses of the pure Devon bull with the older stock of the country, which is originally of mixed English and Dutch of various kinds. The cows exhibited were nearly all Devons, and there was a beautiful Devon bull in the yard which had been bred in Canada. In the Western

and South-Western States the short-horn blood predominates, and of this blood there were some good specimens exhibited.

The Merino sheep are great favourites, and in the Rembouillet stock the carcass has been much improved. If they have dry lying, they stand the winter well in open sheds.

Of horses there was a large show. Of that fast-trotting horse which is so much fancied in this country there were many exhibited. It is in the exigencies of a new country, where few horses could be kept by the small farmers, and the necessity for having them of a kind which could both work in the field and go fast to market, that we find the origin of that general lightness of body which distinguishes the Canadian and other North American horses. They are, in general, too light for heavy farm-work; and when the period arrives for deep-ploughing, and more extensive cultivation of heavy land, a heavier and stronger stock of horses, still preserving a quick step, will gradually take the place both of the oxen, (which, in many of the States, are now extensively employed,) and of the limber-horses, with which they are sometimes yoked in the same team.

Let us now gather a few of our author's most interesting remarks upon *maize*, or Indian corn.

Maize is by far the most productive grain-crop of America. We have already mentioned the beneficial influence of gypsum on its growth; but, like most other American crops, it gets little manure of any kind. Cattle eat its stalks very willingly; and they are said by some to be equal to the best hay in feeding, and to produce more milk than hay does. Of course, the degree of ripeness to which the corn is allowed to attain, the variety grown, the soil on which it grows, the fierceness of the sun beneath which it ripens, and other circumstances, will affect its value as a nutritive fodder. "Much has been said at different times," says Mr Johnston, "about the introduction of Indian corn as a field-culture into England—an object which, I fear, our feeble summer-heats, our cloudy days, and early frosts will prevent us from ever extensively attaining; but as a green food, to be cut in its unripe state, and given green or dried for winter, it might be introduced with a chance of profitable success."

Until the famine years of 1847 and 1848, the quantity of maize exported from the whole United States was exceedingly small; but from 100,000 quarters in 1845, it rapidly rose to upwards of 2,100,000 in 1847, after which it fell to 500,000 in 1848, and "has since continued to decline." But, adds our author, "make it an object to the Central States to send their maize to England, instead of converting it into pork for the packers of Cincinnati, and, as I have not examined those States, I do not know what limit should be placed to the quantity they could continue to send us for many years to come." The State of Ohio—one of the most prosperous in the Union, and now containing a population of nearly two millions—is admirably suited, both by soil and climate, to the growth of Indian corn; and this grain is produced there in such quantities as to be quite a drug. A home outlet, therefore, was sought for; and the distilling of whisky and the fattening of hogs are the means of consumption which have been found most easily available, and most generally profitable. The following is the Professor's account of what is called the *hog-crop* of Ohio:—

The hogs are allowed to run in the woods, and feed on the acorns, &c., till five or six. weeks before killing time, (8th or 10th November,) and are then turned into the Indian-corn fields, to fatten them and harden their flesh. They are usually from eleven to eighteen months old when they are killed; and the longer they have been in the corn-fields, the better is the pork.

The *packing business* of Ohio (as this trade is locally named) has been gradually concentrating itself in Cincinnati, where, in the winter of 1847 and 1848, about 420,000 hogs were sold, killed, and packed. The blood is collected in tanks, and with the hair, hoofs, and other offal, is sold to the prussiate-of-potash manufactories. The carcass is cured either into barrelled pork or into bacon and hams, and the grease rendered into lard of various qualities. Some establishments cure the hams, and after cutting up the rest of the carcass, steam it in large vats, under a pressure of seventy pounds to the square inch, and thus reduce the whole to a pulp, bones and all, and draw off the fat. The residue is either thrown away or is carted off for manure. One establishment disposes, in this way, of 30,000 hogs. Of the lard, the finest is exported—much of it to the Havannah, where it is used instead of butter. About thirty factories are engaged in the manufactory of lard-oil and stearine, which is done by compressing the lard at a low temperature. The stearine is made into candles on the spot, of which 6000 lb. are manufactured every day, on an average of the whole year. The lard-oil is partly sold as such, but in the Eastern States is used to adulterate spermaceti oil, and in France to lower the price of olive-oil. It is said that, in this latter country, from 65 to 70 per cent of lard-oil is often mixed with the olive-oil without detection. The mixture is more apt to deposit stearine, however, than the pure oil, and such an appearance may lead to its detection.

The less pure lard, and the fat extracted from diseased animals and from the offal, is used in the manufacture of soap. Besides soft and fancy soaps, there are made at Cincinnati about 100,000 lb. of soap weekly, and of the fat employed about 80 per cent is pork grease. Lastly, the bristles give rise to a separate business, employing a hundred hands, and the hoofs are partly boiled down into glue.

The marketable products of the 420,000 hogs packed at Cincinnati may be thus summed up—

Pork (150,000 barrels,) . .	29,400,000 pounds.
Bacon, ...	21,000,000 ...
Lard (No. 1,)	13,800,000 ...
Lard oil, ...	1,000,000 gallons.
Stearine candles, . . .	1,875,000 pounds.
Bar soap, ...	5,200,000 ...
Fancy and soft soaps, . . .	7,300,000 ...
Prussiate of potash, . . .	50,000 ...

This is the yearly produce of a stock of about a million and a half of hogs in the State of Ohio. In the whole United States, the entire hog stock is estimated at upwards of 40,000,000. Hog-rearing must therefore be regarded as one of the most important branches of rural economy, and the hog-crop one to which yearly attention should be given.

Next to Ohio, this packing business is carried on most extensively in Indiana and Kentucky—and these seem to be the three States in which the faculty of growing maize, and of producing abundant acorns, coexist most extensively. A similar branch of industry exists in Canada, though the method there is somewhat modified.

The pig husbandry in Canada and in the province of New Brunswick, to be conducted economically, requires to be somewhat modified in comparison with the method adopted in Ohio, and the other large hog-growing and Indian-corn producing States. Of the vast number slaughtered at Cincinnati after harvest, the ages vary from a minimum of eleven to a maximum of nineteen months. They are generally kept over one winter, and *packed* before the next commences. In the Provinces, the first difficulty which the settler has to overcome is that of laying in a sufficient stock of food for the long months of winter; and although the introduction of a

better husbandry will by-and-by greatly lessen this difficulty, yet at present it is a main object with the farmer to get the winter over at as little cost of food as possible. The aim in regard to pigs is, therefore, to obtain a breed which shall litter in April, and can be fed to produce a barrel of pork (196 lb.) in November or December of the same year, and thus to save all winter keep, except for the breeders. As the lumber trade retires farther back, and becomes less extensive, the large and fat pork which was in demand for the lumberers becomes unsaleable, and a new form of the article—such as a civilised community are likely permanently to consume—is necessary to be produced.

Another mode of consuming this abundant grain-crop is *distillation;* and ardent spirits are thus manufactured in large quantities both in Canada and the States. Cincinnati in Ohio—which we have already named as the centre of the packing business—is also the great centre of the whisky manufacture; and probably larger stocks of whisky are to be found at one time in that city than in any other market in the world. The whole quantity produced by the distillers of this city, or brought into it from more or less distant distilleries, is about a thousand barrels (of 40 gallons each) per day, or 14½ million gallons in a year. The quantity shipped off in the state of whisky—chiefly down the Mississippi—is estimated at eleven million gallons, while about one million gallons more are converted into alcohol, and disposed of to the Atlantic States. "All this whisky is manufactured from Indian corn; and even for mashing, barley is not necessary, as sprouted Indian corn makes a malt as serviceable to the distiller as that from barley."

In Canada, which is not so much of an Indian-corn country, this grain is also used in the distilleries, although not so exclusively as in the Western States, where this grain is a drug. I had the opportunity of conversing with the intelligent and enterprising owner of a large distillery in the neighbourhood of Kingston, who informed me that he used chiefly rye and Indian corn, but sometimes *pease* also—all ground up together. Two bushels of barley malt were sufficient for a bushel of crushed rye—Indian corn requires four bushels to one. When barley is scarce, a larger proportion of rye can be used. I was most interested in the use of pease, which, from their composition, one would not expect to be well fitted either to give a good sample or a large return of spirit. He informed me, however, that the yield was tolerably good, but the quality inferior to that from Indian corn—the main objection being, that the spirit carries the flavour of the pea along with it.

We conclude our present notice of the Professor's most excellent work, by introducing to our readers a pest of the farm from which our colder climate luckily exempts them, and which is too nearly allied to one of the "plagues of Egypt" to be agreeable anywhere:—

In walking over Mr Porter's farm, my attention was drawn to the vast number of grasshoppers which were jumping about, not only in his grass, but in his turnip fields. I had observed them previously in considerable numbers at various places on the St John River, but here the land seemed almost alive with them. They appear during the hot weather of midsummer and autumn, and attack the turnip crops as well as the grass, sometimes entirely stripping them of their leaves. If the young turnips are not sufficiently forward by the middle or end of July, when the grasshoppers begin to swarm, they are sometimes entirely destroyed. This is a pest of which our British turnip-growers, so far as I am aware, have no cause to complain.

In New England, five or six different grasshoppers, besides as many species of locust, appear in their warm summers. In Massachusetts, the grass in the meadows

and moist fields is filled with myriads of small grasshoppers, of a light green colour, which do much injury to the grass. But, in New England, grasshoppers are not generally distinguished from the small varieties of locusts which are common in that country. One of these, the small red-legged locust, about an inch in length, infests the salt-marshes in such numbers as almost entirely to consume the grass ; and when the scanty crop of hay is gathered, it is so tainted with the putrescent bodies of the dead locusts contained in it that it is rejected by cattle and horses. It is some small return for their ravages that the bodies of these creatures manure the fields they have infested, and that poultry thrive upon them. Young turkeys, in the summer, live almost entirely upon these grasshoppers in parts of Massachusetts, and become fat.

Weather Prognostics of the Equinoxes. By J. Towers, M.R.A.S.E.—Here is a subject worthy of attentive observation and record. These periods, it is familiarly known, occur twice in the year ; not, however, so precisely as to divide it into two equal portions of time, but pretty nearly so. The vernal equinox of March last was, on the twenty-first morning, at 56 minutes after four o'clock, when the sun crossed the equinoctial line, and entered the first of the zodiacal, or northern signs, (the Ram.) The autumnal equinox will occur on the 23d of September, at 51 minutes after 3 o'clock of the afternoon, Thus, it will appear that nearly 187 days elapse between the vernal and autumnal equinoxes of 1851.

The extraordinary weather which has characterised the present season—wherein, since the first week of March, some have ventured to estimate the quantity of rain at about fifteen times that of March 1850—seems to demand some notice of the influence which the intersections of the two great circles may produce.

In the year 1822 my attention was called to this subject by a clergyman, then resident at St Peter's in the Isle of Thanet, a relation of the late Archbishop Sutton. Since that date, I have not failed to notice every equinox, and also repeatedly to compare the phenomena with the data furnished by *The Summary of the Weather* in that pleasing and instructive book, White's *Natural History of Selborne.* In 1827, I wrote, and subsequently printed, the remarks which I now copy.

The vernal equinox takes place during this month, (March,) and experience seems to authorise the conclusion, that, *according to the character which the weather assumes about that period, the succeeding summer will, in all probability, be either wet or dry.* Kirwan and others have given rules, founded upon repeated observations, from which some probable opinion can be formed. It appears to me to be placed beyond doubt, that, if north or north-east winds prevail on or about the period of the equinox—that is, from about the 18th to the 25th of the month, especially if the barometer be high and the mercury show convexity—the succeeding summer will generally be dry. If, on the contrary, south or south-west winds prevail, the summer will, *in greater probability,* be wet. Kirwan says, "If there be a storm at south-west, or west-south-west, on the 19th to 22d of March, the succeeding summer is generally wet *five times in six.*" I quote this from memory. It does not seem improbable that, when the sun shines perpendicularly upon the equator, illuminating the whole hemisphere, so as to cause equal day and night throughout the world, the electro-magnetism of our planet, and possibly that of the moon also, may be so regulated by the sun's electrising principle as to induce a peculiar modification of atmospherical currents about the equatorial regions, that shall influence the general state of the winds in distant latitudes.—*Nat. Kal.—Domestic Gardener's Manual.*

Whatever may be thought of *causes*, certain it is that my own observations in Kent, Wiltshire, Berkshire, and Surrey, have to this present time confirmed the equinoctial prognostic—if so it may be termed—with scarcely an exception. But, in order to avoid misconception on a point of so much consequence as the establishment or repudiation of a theory of great importance to agriculture, it is needful to state that the equinoctial indications are fourfold, and comprise so many principles. The two first assume that, if the weather be consistently either wet or dry, a day or two before and after either of the equinoxes, a wet or dry season will be established, and, in all probability, extend through the five following months. In this category we find the equinox of the present year. After the fine weather of the first weeks of March, a change of wind to E.S.E. took place on the 17th, which introduced those deluges of rain that at length have saturated the land, and balanced the account of averages that had been so long minus, in consequence of the paucity of rain-water for several seasons. On the 18th and 19th, the current from S.W. was so forcible as nearly to amount to a storm, The barometer declined gradually from 29 in. 68 cents to 28 in. 77 cents on the 22d. The atmosphere was overcast with clouds, and almost sunless, excepting for a few hours on the 23d, 28th, and 31st days.

If we compare the quantities of rain that fell in the two months of March 1850 and 1851, the excess in favour of the latter will be found enormous—in the proportion, according to some registers, of from twelve, or even fifteen, to one.*

A *third principle* is derived from the two first, and rests upon the general feature of the weather, and its meteorology, about the equinoctial periods. These may be, and occasionally are, of a *mutable*, and even *varying character;* and however localities may differ in latitude and longitude, certain it is that corresponding seasons are of not unfrequent occurrence, and which tend to harass and perplex the farmer at harvest time.

The *fourth principle* I have derived from actual observation at the exact periods of the passage of the sun across the equator is, that on several occasions, after the weather has been fine and sunny,

* Since writing the above, I find, at p. 245, col. 3, *Gardeners' Chronicle*, April 16, the following :—"There is no record of so great a quantity of rain as that which fell during the month of March last. At Hyde Vale, Greenwich, 4.02 inches in depth fell; at the Observatory, above 4 inches; at Lewisham, in Kent, 4½ inches; at Epping, above 5 inches; and it has been equally great in proportion through England. The average quantity for March, nearly the driest month in the year, is 1.71 inches. The quantity, then, has been 2½ in some places in excess. The number of days on which it rained was 18; and on Saturday the 15th, nearly 1½ inch fell in 15 hours—a circumstance quite unprecedented at this season of the year. March of 1818 was next in wetness, when 3.45 inches in depth fell; the spring altogether was cold stormy, and very late, and was followed by a very hot, dry, summer—which was, however, on the whole, very unproductive." I resided in London in 1818, and did not keep my registers so accurately as I have done since 1819; but I perfectly recollect the characteristics of that year.

till the 17th or 18th of March—and even up to the very hour of the intersection of the lines, according to the Almanac—a complete change in *all* the meteorological phenomena has at once taken place, and a contrary state of the weather been induced. Thus I have been led to infer that the *spring equinox*, at least, occasionally exerts a *changing* power, and particularly under the circumstances just mentioned.

Here it may not be irrelevant to call attention to the oaks and ash-trees. Where a few of each stand in close proximity, the observations may be satisfactory in comparison. As yet, (April 19,) I find the oak forms its close-set buds, the ash rapidly developing its flowers. Three days have been warm—the maximum at 2 o'clock 64° or 65°.

In attempting to establish or repudiate any theory, it is needful to appeal to experience and the evidences of facts. I therefore adduce the authority of the late Rev. Gilbert White, and from his *History of Selborne* extract the following passages, which I find in the Summary of the Weather, commencing with the year 1768, and brought down to the end of 1792. By a table of the amount of rain which fell at Selborne between 1782 and 1793, we perceive that the quantity in that "woody and mountainous district" must be considerable, exceeding by far the annual average that falls in Surrey, Kent, or Essex. From this table I quote the items which follow :—

MEASURE OF RAIN IN INCHES AND HUNDREDTHS.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1782	4.64	1.93	6.54	4.57	6.34	1.75	7.09	8.28	3.72	1.93	2.51	0.91	50.29
1785	2.84	1.80	0.30	0.17	0.60	1.39	3.80	3.21	5.94	5.21	2.27	4.02	31.55
1787	0.88	3.67	4.28	0.74	2.60	1.50	6.53	0.83	1.56	5.04	4.09	5.06	36.24
1788	1.60	3.37	1.31	0.61	0.76	1.27	3.58	3.22	5.71	0.00	0.86	0.03	22.50
1790	1.99	0.49	0.45	3.64	4.38	0.13	3.24	2.30	0.66	2.10	6.95	5.94	32.27
1791	6.73	4.64	1.59	1.13	1.33	0.91	5.56	1.73	1.73	6.49	8.16	4.93	44.93

Now as to particulars, which, though they prove that Mr White entertained no idea of equinoctial influence, yet bear upon that question, and go some way toward the solution of the problem :—

1°—1782. To February 4th, open mild weather ; to 22d, hard frost. To the end of March, cold-blowing weather, with frost, snow, and rain. To May 7th, cold dark rains. To the end of May, mild, with incessant rains. To the end of June, warm and dry. To the end of August, warm, with almost perpetual rain.

Here is an example of a wet spring and harvest season after a bad March.

2°—1785. Thaw began on the 2d January, and rainy weather, with wind, continued to the 28th. To 21st of March mild, with sprinkling showers. To April 7th, hard frost. To 17th May, mild windy weather, without a drop of rain. To the end of May cold, with a few showers. To 9th June, mild weather, with frequent soft showers. To July 13, hot dry weather, with a few showery intervals. To 22d July, heavy rain. To the end of September, warm, with frequent showers. To the end of October, frequent rain. To the 18th November, dry mild weather, (hay-making finished November 9th, and the wheat-harvest November 14th.) To December 23d, rain. To the end, and to January 7th, frost and snow. To January 13th, mild, with much rain. From 21st to February 11th, mild, with frequent rain.

A changeable March, followed by a catching showery summer; a mild, wet autumnal equinox, succeeded by a dripping autumn, a short duration of frost, and a return of falling weather, till the 3d week of February 1786.

3°—1787. To January 24th, dark, moist, mild weather. To 28th, frost and snow. To February 16th, mild showery weather. To February 28th, dry cool weather. To March 10th, stormy, with driving rain. To 24th, bright frosty weather. To the end of April, mild, with frequent rain. To May 22d, fine bright weather. To the end of June mostly warm, with frequent showers, (See on the 7th.) To the end of July, hot sultry weather, with copious rain. To the end of September, hot, dry weather, with occasional showers. To November 23d, mild, with light frosts and rain. To the end of November, hard frost. To December 21st, still and mild, with rain. To the end of the year, frost.

Here we have a changeable March and spring and summer to the end of July, a dry autumnal equinox leading to a keen winter.

4°—1788. To January 13th, mild and wet; to the 18th, frost. To the end of the month, dry windy weather. To the end of February, frosty, with frequent showers. To March 14th, hard frost. To the end of March, dark harsh weather, with frequent showers. To the 4th of April, windy, with showers. To the end of May, bright, dry, warm weather, with a few occasional showers. From June 28th to July 17th, heavy rains. To August 12th, hot dry weather. To the end of September, alternate showers and sunshine.

The rain-table for this date exhibits the lowest average—namely, 22 in. 50 cents. Yet the greatest volume of rain fell during the three summer months responsive, so to speak, with the indication given in the last fortnight of March.

5°—After noticing the weather to February 22, 1790, we read—To April 5th, bright cold weather, with a few showers. To April 15th, dark and harsh, with a deep snow. To April 21st, cold cloudy weather, with ice. To June 6th, mild spring weather, with much rain. From July 3rd to 14th, cool, with heavy rain. To the end of July, warm dry weather. To August 6th, cold, with wind and rain. To August 24th, fine harvest weather. To September 5th, strong gales, with driving showers.

The indication for the summer was not definite, yet, considering the locality, the weather proved to be on the favourable side of changeable. But now we read that, from the last given date "to Nov. 26th, was mild autumnal weather, with frequent showers." Here there is a clear prognostic of a mild, wet winter; and in proof, the rain-table of November, December, and January and February, 1791, shows a fall of rain amounting to 24 in. 26 cents—about the average of the entire yearly volume in the drier south and south-eastern counties. From December 1st to the end of the year, rain and snow, and a few days' frost.

6.°—1791. To the end of January, mild, with heavy rains. To the end of February, windy, with much rain and snow. From March to the end of June, mostly dry—especially June; March and April rather cold and frosty; May and June hot; July rainy. Fine harvest weather, and pretty dry to the end of September.

Had Mr White taken notice of the equinoxes, or of their probable influences, something more definite would have occurred in his Summary.

I now adduce a few facts from observations made at the several

dates by myself, first observing that some persons claim exceptions, because, at three different periods during a century, *a wet March* had been succeeded by a dry summer. Thus it is stated that, in the year 1818, March, and the spring up to the middle of May, was very wet; but the summer was quite dry, and peculiarly hot. I admit the fact so far as regards the summer, which I have ample reason to remember. The last rain of the spring in London fell in immense volume, about 10 P.M. on the 17th or 18th of May, and previously abundance had fallen at various times; but I imagine that the bulk fell *prior* to the 20th of March. The drought continued to September, so that the fields about the metropolis were converted to dust; and the wheat was, by the power of *solar* direct light, deprived of its usual deep colour, the ears and straw assuming a very pale buff tint.

" The March of 1828 was dry and serene till the 18th, with the barometer, at an average, above 30 inches; but west and south-west winds generally prevailed. On the 18th the mercury began to decline—*cumulo-cirro-stratus*, or compound suffused cloud, formed —and a south-west gale succeeded. The wind, however, veered to west-north-west early on the 19th, and during this period the equinoctial point was passed. Such were my own *local* observations in Wiltshire; the character of the succeeding summer requires no elucidation—it was not at all local, but everywhere wet. The equin· ·:al periods of 1829 and 1830 indicated wet summers; those, on the contrary, of 1831, 1832, 1834, and 1835, predicted fine or dry summers: the results corresponded."—(*Domestic Gardener's Manual*, p. 128.)

My *Characteristics*, published in several past years in this Journal, may be referred to—the one of 1850 is before me. At page 672, a few lines on the vernal equinox indicated a *changeable* prognostic. Referring to the last paragraph of page 676, we read: " Now, as *to the equinox* of the 23rd, (Sept.,) when the sun entered *Libra* at 10 A.M. The wind had gone backward to east, but returned to west, or west by north; barometer falling, weather rainy, followed by much more wet on the 24th. Solar spots observed at bright intervals. The indications were certainly favourable to a mild, changeable winter." Has not the weather responded accordingly? As to *solar spots*, I have ceased to look out for *them*, and certainly never regarded their appearance as unfavourable phenomena; at all events, these maculæ are of such frequent recurrence, (being rarely absent,) that no one can be justified in predicting cold and wet weather therefrom.

May 3rd.—After a few days of cool but improved weather, more favourable to the inauguration of the National Exhibition, hoar-frost, succeeded in a few hours with dense clouds and drizzle, has again visited us—sad confirmation, so far, of our views. Hope remains, an anchor at all times—and on this occasion is chiefly founded upon the possible condition that, as in 1818, the volume

already poured upon the earth will have sufficed, and that the "weird" is, We will erelong "be dree'd."

The Lentil—a new British Crop.—As the direction of agricultural inquiry seems of late years to have been turned especially after improved varieties and new species of grain, we shall give our readers a short account of the cultivation in Scotland, and the history of the Lentil, or *Ervum lens* of botanists.

The lentil, although a new field-crop in Scotland, is so well known abroad, especially in Catholic countries, that the very name *Lent* —given in our country to the long fast of forty days, called *Carême* in France—appears unquestionably derived from the use of lentils during that period of abstinence from all sorts of animal diet. Its nourishing qualities were evidently known very early in the East; for we find its uses, both for the making of bread and pottage, recorded in several portions of the Old Testament. The "red pottage" (Genesis xxv. 29, 34) for which Esau sold his birthright, was made of lentils; and several references to them occur elsewhere in the Bible, as in Samuel xvii. 28, and xxiii. 11; Ezekel iv. 9, &c. "The lentil," says Lawson, "is a legume of the greatest antiquity, being in esteem in the days of the Patriarchs, and much prized ever since. In Egypt and Syria, the seeds are parched in frying-pans, and sold in shops for those who undertake long journeys." According to Dr Sh[illegible], the lentil forms a chief article of food in North Africa and [illegible]estern Asia. We are told, too, in the *Gardeners' Magazine of Botany*, "that the Hindoos add lentils to their rice diet when engaged in laborious work;" and Dr Royle, the first authority on the subject, records that now, as anciently, the lentil forms a chief article of food among the labouring classes. In France, Germany, Holland, all over continental Europe, the lentil is generally used in boarding-schools, in the army, in large families, and in hospitals, as one of the most nutritious and succulent legumes in existence, if not the first, for Einhoff obtained from 3840 parts of lentils, 1260 of starch (*fecula*,) and 1433 of a matter analogous to animal matter. From the researches of Playfair, it would appear also that the lentil is the most nutritious of all leguminous plants, containing more nitrogenous matter than any other, including the pea, the bean, and their varieties.*

* We observe that a remark, signed by J. L., in the Illustrated Catalogue of the Great Exhibition, after stating all the above particulars, concludes by these inconsistent words —"Yet not very wholesome." Is it possible to suppose that the French, Spanish, German, and Italian medical men would order an *unwholesome food* to be one of the chief diets in hospitals, &c.? Would an *unwholesome food* have been long, and be still, retained throughout the East as *one of the chief foods* for the labouring classes, and enter as a *great ingredient in French cookery?* In a note which we have seen, to M. Guillerez, who naturally complained of so disparaging a remark having been attached in the catalogue to the sample of lentil he was exhibiting, Dr Lyon

The *Ervum lens* belongs to the general order of *leguminosæ ;* its calyx is five-parted ; segments linear, acute ; corolla, sub-equal ; pod, oblong ; one, two, and three seeded. Six species are natives of the Northern Hemisphere. The species termed botanically *Ervum tetraspermum hirsutum* presents us with those troublesome weeds of the New Testament parables called tares. They are natives of England ; but the *Ervum lens* is a native of Eastern Asia, and of the south of Europe.

We come now to the introduction and cultivation in our country of that most excellent, nutritious, palatable and prolific seed.

Some years ago, at the time of the failure of potatoes, and the consequent distress of the poorer classes in Ireland and the Highlands, M. Guillerez, a French teacher, of Castle Street, Edinburgh, attempted to cultivate the lentils at South Queensferry, as a substitute for potatoes; and he spared neither trouble nor money, during three years, till he had fully succeeded in his experiments, although under the most unfavourable circumstances. It is true that the lentils were introduced into this country about the year 1545, but their cultivation was never attended to, and was entirely lost sight of. In 1835, Messrs P. Lawson & Son ripened specimens of the larger lentil, (not the best) at their Meadowbank nursery, but did not carry their experiments further. The only systematic and persevering attempts to ripen the seed, and acclimatise the plant, have been those of M. Guillerez, who has been awarded the large gold medal of the Highland and Agricultural Society in January last. He has sent specimens to the Great Exhibition. These attempts were carried on at Queensferry; and it has been found that seed of his own produce, ripened there, had proved more luxuriant than Continental seed newly imported from France, given to him in exchange by Lord Murray. At the moment we write these lines, M. Guillerez, not being discouraged by a lawsuit which he lost against the owner of the ground where he grew his lentils — through his ignorance of the law of this country in reference to leases — has selected another plot, in the same locality, and sown about the eighth of an acre with the two best kinds of lentils, which are already two feet above the ground.

Here, then, we have room to hope that the lentil is in a fair way of being acclimatised.

M. Guillerez's plants grew, last year, to two, and even three feet in height — a luxuriance seldom attained in France. A dry, sandy, calcareous soil, in a sunny exposure, is requisite for the lentil ; yet this gentleman sowed his seed in heavy garden-ground, exposed to all winds, manured with sea-weed and very

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Playfair remarks—" I hope the *injustice* of which you complain will be removed in the second edition. I agree with you as to the importance of introducing the cultivation of lentils into this country."

little common manure. He put in the seed at various periods, the birds and insects having destroyed the greatest part of the lentils sown too early; and he has arrived at the conclusion that the worst kind of soil is adapted for the growth of lentils, and the best time of sowing is the middle of March, or the beginning of April.

They are sown in rows two feet apart, if they are to be propped by stakes; or eighteen inches, with a row of beans between every row of lentils, to support them, if they are not properly sheltered from the winds. The seed in the drills must be pretty thin, like turnips. In open fields, the lentils are sown like tares, broadcast.

The plant is of a close branching habit, producing from 100 to 150 pods: M. Guillerez counted 134 on a single stalk. Care must be taken to keep away the birds; for pigeons, blackbirds, and sparrows, are very fond of the lentil when it begins to pod.

There are three kinds or varieties of lentils cultivated in France and Spain. The lentil of Provence is as large as a pea, with a luxuriant straw, and is more fit to be cultivated as a tare, than for the grain as human food. The small brown or red, when the seed is old, has the most agreeable flavour, and is preferable to all the others for haricots and soups. The yellow lentil, a little larger and more flat than the second kind, being more easily unhusked, readily converts into flour, and serves for the base of those adulterated preparations so much and so long puffed in our journals. It is only the two last M. Guillerez has successfully ripened in the open air at Queensferry.

"The produce of lentils in grains," says Lawson, "is about a fourth less than that of the tare; and in appearance is not a third as much, the plants seldom growing above one and a half feet high;" yet the lentils sown by M. Guillerez have attained two, and even three and a half feet. "The straw is very delicate and nourishing, prepared for lambs and calves; and the grain, on the Continent, sells at nearly double the price of peas; but there is more food in one part of lentils than in two of peas, and they swell much by cooking." A *litre* of lentils (about 2 lb. weight) entire, unhusked, will produce two large and substantial family dishes, at a cost of from fourpence to fivepence; and if cultivated in our own fields, at a much less expense.

How is it that a vegetable so generally used on the Continent, cheaper, and more wholesome, more nutritious, more susceptible of digestion and assimilation as human food than any description of pease or beans, making delightful soup, very savoury to the taste when cooked with ham, or when its farina is used for puddings or *purée* with any kind of meat, should be almost unknown in this country? The character of the lentil, both intrinsic and economical, seems to point it out as a substitute for the potato; and the important question is, whether it would thrive under general culture, in this soil and climate, as luxuriantly as that root? One of our scientific growers, (Lawson) has given his

testimony in the affirmative.—*Agriculturist's Manual*, p. 95. Why is it then, that, having free trade in corn of all kinds, this foreign crop is not in the mean time more largely imported for British consumption? The seed is not to be found even in our best seedsmen's shops, and M. Guillerez gave a few pounds of his own crop to one of our best seedsmen, in exchange for small seed worm-eaten and twenty years old—having never been asked for, and yet good enough for seed. We understand that M. Guillerez is willing to give his last 15 lb., in small lots, to any farmer who wants to try the cultivation of them immediately. What prevents the landlords of Barra, Skye, the Highlands, Shetland, &c., from trying them on a small scale, at first, since they have plenty of sandy or calcareous soil and sea-weed for manure? Let it be remembered, that the cultivation of the lentil is not more difficult than that of the pea; that their harvesting is the same, and they ripen sooner, being ready in the first week of August if sown in March or April.

A Decade of Fiars and Average Prices of Wheat.—Having in a former Number (Vol. XI. p. 264) given a table of the fiars prices of wheat in the several counties of Scotland for eight years, from 1832 to 1839, and compared these prices with the average of all England, as well as one county with another, we are induced, from the low prices now ruling in the grain market, to lay before our readers the prices of wheat from 1840 to 1850 inclusive, showing the range of prices at the former, as also those at the latter period. The fiars prices of grain in Scotland comprehend the sales from the cutting of the crop till the end of February in each year, while the averages of all England comprehend the sales for the whole year, from January to January. A tenant in England, having 1000 quarters of wheat to sell, would receive, on the average of nine years, from 1840 to 1848 inclusive,

age of nine years, from 1840 to 1848 inclusive,	£2927	1	8
But for crop and year 1849 only . .	2212	10	0
Leaving a deficit of	£714	11	8
And a tenant in Scotland, for the same quantity, in the former period would receive .	£2480	4	2
But for crop 1849, ...	1761	9	2
Leaving a deficit of	£718	15	0
Average price from 1840 to 1848 inclusive,	£2927	1	8
Average price in England for crop 1850, .	2025	0	0
Leaving a deficit of	£902	1	8
Average price from 1840 to 1848 inclusive,	£2480	4	2
Average price in Scotland for crop 1850, .	1838	10	10
Leaving a deficit of	£641	13	4

The Scotch farmer having the advantage over the English one of £260, 8s. 4d.

FIARS PRICES of WHEAT in SCOTLAND for the last ELEVEN YEARS, from CROP 1840 to CROP 1850 inclusive, as determined by a Jury each Year in each County.

COUNTIES.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.
	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.
Aberdeen,	..	..	..	48 0	..	60 0	56 4	50 0	41 0	33 2	35 5
Argyll,	..	..	39 0	42 10	45 6	50 8	68 0	49 4	45 4	38 6	36 8
Ayr,	45 5½	56 5¼	43 11	46 8¾	43 9½	47 10½	62 11½	50 3¼	44 8	35 0¼	36 1
Banff,	55 6	56 6	45 8	50 7	42 3	54 3	64 6	55 3	47 3	36 8	39 10
Berwick,	52 10 8/12	54 11 9/12	44 10 7/12	50 7 7/12	42 0 1/12	48 9 3/12	62 2 1/12	51 4 6/12	45 3 3/12	35 0 6/12	35 9 4/12
Bute,	47 10¼	56 10	45 0	46 3	44 2¾	49 10½	61 10	48 7	46 8	34 8¾	35 7
Clackmannan,	51 6	44 9½	44 2¾	45 5	42 5½	49 5½	64 0½	53 6	43 5¼	34 7½	35 5½
Dumbarton,	50 1	56 3	43 6	48 1	45 5	53 8	60 5	49 10	47 4	36 9	37 5
Dumfries	51 10	60 0	47 6	48 10	48 0	53 8	78 0	57 0	49 10	39 8	38 8
Edinburgh average,	54 4	52 3	43 6	50 6	41 8	42 5	61 0	43 9	42 4	31 0	34 8
Elgin,	55 0	58 0	43 7	50 3	41 3	52 3	65 1¾	54 5	48 0	37 5	38 8
Fife,	53 1	44 10	43 3	48 7¾	40 10¼	49 5¾	61 11¾	52 1¾	43 8	33 0½	36 2½
Forfar,	56 6	40 6	44 0	50 0	42 0	53 4	65 5	52 8	43 4	34 11	36 6
Haddington average,	61 9¾	62 6	48 11	51 3¼	46 5½	54 9½	63 11½	55 0½	51 7½	36 11½	39 6¾
Inverness,	52 7	57 0	41 8	48 9	42 2	51 5	62 8	54 6	48 6	36 1	37 8
Kirkcudbright,	51 8	56 0	48 4	48 8	46 0	51 4	67 4	54 6	46 8	37 4	38 4
Kincardine,	60 5	38 10	44 11½	49 6¼	41 4¾	54 10	62 9½	54 9	45 0¼	34 5	35 7
Kinross,	46 2	37 0	38 8	43 0	36 1	37 0	53 0	49 6	34 2	31 10	30 8
Lanark average,	44 10 4/12	50 2	42 3	44 6	43 6	43 6	61 6	49 6	41 0	34 8	35 7 4/12
Linlithgow,	54 4	47 5	44 11	48 1	42 6	47 2	62 6	52 5	44 8	34 6	36 10
Nairn,	56 6	58 6	42 0	51 0	42 6	54 0	65 0	54 0	47 0	37 10	38 6
Peebles average,	59 3	47 3	44 7¼	48 0½	42 6¾	39 10½	62 0½	48 8	38 1¼	32 0	40 4¼
Perth average,	59 6	46 10	42 11	45 11	39 10	48 1	58 1	50 11	40 9	30 11	34 3
Renfrew,	51 6	54 7½	45 2	46 11½	45 1½	47 11½	63 6½	50 8½	46 1½	35 2¼	37 2
Ross and Cromarty,	48 8	46 9¾	40 7½	48 2¼	40 1	52 6½	64 8¼	50 11	41 2	34 11	36 0
Roxburgh,	54 6 6/12	60 5 4/12	45 10 1/12	49 9 4/12	42 11 6/12	50 0 6/12	63 7 10/12	53 8	48 3 5/12	36 1 5/12	36 6 6/12
Selkirk,	52 4	60 0	44 0	48 0	41 6	46 0	69 6	56 0	42 8	36 0	37 4
Stirling,	48 4	42 0	40 6	44 0	38 8	44 0	58 10	49 8	41 0	33 4	35 4
Sutherland,	..	..	..	..	46 0	..	60 0	..	41 0	37 5	39 6
Wigton,	41 4	49 10	43 10	46 4	43 4	48 0	61 2	47 6	43 8	34 8	35 6
Averages,	52 2 2/12	51 8 7/12	43 9 8/12	47 10 9/12	42 9 8/12	49 2 8/12	62 9	51 9	44 3 9/12	35 2 9/12	36 9 3/12
Highest prices in each column,	61 9¾	62 6	48 11	51 3¼	46 5½	60 0	78 0	57 0	51 7½	39 8	40 4½
Lowest do.,	41 4	37 0	38 8	42 10	36 1	37 0	53 0	43 9	34 2	30 11	30 8
Difference,	20 5¾	25 6	10 3	8 5¼	10 4½	23 0	25 0	13 3	17 5½	8 9	9 8¼
General average of England,	66 6	64 5	57 3	50 1	51 3	50 10	65 7	70 6	50 6	44 3	40 3

The Effects of Burnt Clay as a Manure. By Dr VOELCKER, Professor of Chemistry in the Royal Agricultural College, Cirencester.—One of the best means of improving stiff clay land, next to thorough drainage, is the practice of soil-burning—an operation which must not be confounded with paring and burning. The latter affects merely the surface soil, whilst in the former, the soil under the vegetable mould is also burned with faggots, brushwood, grass-sods, all kind of vegetable refuse matter and coal, where it can be obtained at a cheap rate. The advantages resulting from burning clay land are so manifest, that in districts where such land abounds, as in the counties of Suffolk, Essex, Gloucestershire, and in localities situated on the Oxford clay, the system of soil-burning has been long since introduced with the best effects. Properly burnt clay is, therefore, justly considered by many farmers as one of the most valuable fertilising materials, which not only improves the first crop, but likewise decidedly benefits several succeeding crops. We have the testimony of several good farmers, that the effects of burnt clay are shown in some instances, even after a lapse of eight years, by the more luxuriant growth of crops and land dressed with burnt clay, when compared with those growing in soils which had not received such a dressing. It would be easy to cite many experiments made both on a small and on an extensive scale in Britain and on the Continent, together with the opinions of high agricultural authorities, all tending to prove the advantages resulting from the application of burnt clay, were such arguments necessary to convince the sceptical on the subject. To produce such conviction is not, however, the object of the following observations. I shall, therefore, merely refer to one or two experiments conducted under peculiar advantages, and affording much instruction. Those who desire further information on the subject, may find it in the valuable papers published in the *Journal of the Royal Agricultural Society of England*, by Mr Pym, vol. iii. p. 323; Mr Randell, vol. v. p. 113; Mr Pusey, vol. vi. p. 477; Mr Mechi, vol. vii. p. 297; Mr Poppy, vol. vii. p. 142; and Mr Long, vol. vii. p. 245.

Mr Pusey testifies to the good effects of burnt clay, chiefly, as he says, on account of the very bad quality of the land on which the burning succeeded. The soil was like bird-lime in wet weather, and in a dry summer like stone, and was purchased for £14 per acre. It was drained with 34 inch drains, at first at 10 feet apart, and then at 30 feet apart. After burning the clay with Essex labourers, a field of 8 acres yielded the following returns of wheat, the natural soil yielding only 16 bushels per acre:—

One acre.	Wheat.
With no manure, ...	$37\frac{3}{4}$ bushels.
.. 80 yards of burnt clay, ...	$45\frac{1}{2}$ ...
... ... and sheep folded, .	$47\frac{1}{8}$ ...

The draining cost £3, 1s., and burning the clay £2, 5s. per acre. The produce was worth £17 per acre.

Mr Pusey justly observes, that burnt clay does not act merely mechanically, but also as a manure, (that is, chemically.) The reason, however, why it does so, and sometimes fails to do so, he does not attempt to explain. To elicit from the nature of the chemical changes, produced by the process of burning, and from a consideration of the various circumstances under which it may be performed, some solution of those questions has been the object of my investigation.

Practical men agree that clay-burning is rather a nice operation, and requires much attention and judgment on the part of the operator. It is well known that, if the heat in burning clay is allowed to become too intense, the result will be that, instead of a friable mass, large hard lumps, resembling brick-bats, will be produced, which rather injure than improve the soil. It is fair to infer, therefore, that ignorance or carelessness, in this respect, accounts for the failure of some cases. All failures, however, cannot be attributed to this cause; for many men, well acquainted with the subject, affirm that some kinds of clay are unfit for burning, because the increase of the crops is not adequate to the expense and trouble of burning and spreading this kind of manure. Now, it is clear that, unless we know the true cause of the effect produced by the application of burnt clay, we are not likely easily to settle, without incurring much expense, which kind of clay is well adapted for burning, and which not. At the same time, the discovery of the cause of the efficacy of burnt clay might lead us to supply the same substances or materials, on which the effects in burnt clay depend, in another form at a cheaper rate. An additional advantage may be derived from this consideration, by which improvements are likely to be effected in the existing methods of burning clay, which shall render them easier, cheaper, and more certain.

These and similar considerations, I think, will at once show the practical importance of a thoroughly fundamental investigation of this subject.

The analyses of different samples of agricultural clays, taken from several geological formations, and even those of the same geological epoch, afford great differences in their chemical constituents. Such clays are generally composed of alumina, silica, oxide of iron, manganese, lime, magnesia, potash, soda, traces of sulphuric and phosphoric acid, and chlorine, in different proportions. It is perhaps just on account of the complexity of composition, and the various changes in the chemical relation of these different constituents, under so powerful an agent as heat, that the difficulty of settling the above questions arises. Room for much speculation is the necessary result of these circumstances; consequently many theories with regard to the effects of burnt clay

have from time to time been advanced by agriculturists and chemists. Even though such a high authority on agricultural chemistry as that of Liebig had made us acquainted with a theory, in explanation of these effects, it must be confessed—and practical men as well as agricultural chemists acknowledge—that we have still much to learn on the subject, before we can, with any amount of probability, offer an explanation of these various effects.

With a view of contributing something to the solution of the problem, I made some experiments during last winter, which have furnished me some interesting analytical results. These, I trust, will throw some light on the rationale of clay-burning, and at the same time show the importance of a more extensive practical application of the process on heavy clay lands.

Before submitting to the reader my own results, I shall take a rapid survey of the history of the observations of others on the subject.

It has been mentioned already that burnt clay appears to have been used as a manure long ago. Amongst those who recommended it, Robert Sommerville, and particularly General Beatson, deserve notice. The General, in his book entitled *New System of Cultivation, without Manure, Lime, or Fallow*, of which a second edition appeared in 1821, mentions the names of Curwen, Boyd, Cartwright, Cray, and others, as observers of the beneficial effects of burnt clay on vegetation, and strongly recommends the practice of soil-burning, as one of the best means of improving land, especially stiff heavy clay soil. The appearance of this work created some sensation at the time amongst the agricultural community and the scientific public, both in this country and on the Continent. It excited, indeed, the curiosity of German agricultural chemists in a high degree, and occupied the attention of several eminent Continental philosophers, in a measure which was scarcely equalled by the attention bestowed on the subject by the scientific men of England. Sprengel, the celebrated German agricultural chemist, Professor Hermbstädt, Professor Kastner, Professor Zierl, Kersten, and, above all, Professor Lampadius, took up the subject with much warmth, and each speculated, after his own manner, on the causes of the alleged beneficial effects of burnt clay. A short review of the labours of these distinguished men, which by no means are so well known by the agricultural public of Great Britain as they deserve, I trust will not be unacceptable to the reader, if it were only for the purpose of demonstrating how fallible the judgments of even great men are, and of inculcating the moral lesson so frequently forgotten by theoretical writers, that theories should be put forward with the utmost caution and modesty. How often do we find a favourite theory offered to the public in a manner in which only a mathematical truth, or a law of nature, confirmed by the experience and labours of many generations, can be advanced, and, after all, the same

theory, stated with so much confidence, and often arrogance, appears very erroneous and even absurd, as the circle of our experience expands. Fortunately for such a theorist, this seldom takes place in his lifetime, but sometimes the decline of his life is embittered by seeing the dreams of his enthusiasm vanishing and exploded, and exposed to the ridicule and scorn of his contemporaries. We long to see the time when caution, modesty, a generous regard for the opinions of others, and, above all, a love of truth for its own sake, shall characterise the mind of natural philosophers, and feel convinced that men whose spirit is so constituted, will not only enjoy themselves a greater amount of happiness and satisfaction, but that the cause in which they are engaged will be decidedly a gainer, and advance more rapidly, and prosper better than it now does.

It must be regarded as a matter of deep regret, that the want of caution and modesty on the part of many scientific men has contributed more than perhaps anything else to bring science into discredit with the agricultural public. Many a practical man, not otherwise entertaining prejudices against science, has been led thereby to undervalue the labours of his best friends, and to regard science—a term of which he often entertains very vague ideas—as antagonistic to practice. In my conversations with farmers, it has often struck me how generally the words *practice* with *science*, which several agricultural societies have accepted as their motto, are misdunerstood. Mere theory and science are synonymous terms, I fear, with most farmers; and many, I am convinced, regard science as the very antagonist principle to practice; and if they adopt the motto Science with Practice, I think it is only because, in their opinion, a little opposition—that is, a little science or theory—keeps a good practice alive. Now nothing can be more incorrect. True science and practice are never opposed to each other. The source from which both are upheld is observation. Well-regulated observation constitutes experience: experience is the mother of sound practice, but it is also the parent of sound science; for science itself is nothing else than the systematic arrangement or generalisation of a number of isolated facts. Where, then, is the antagonistic principle between science and practice?

The labours of Lampadius demand our special notice. With much interest and zeal he took up the investigation into the causes of the beneficial effects resulting from the application of burnt clay, brick-dust, and burnt soil in general; and during the years of 1829-36, he continued his experiments, which are full of instruction, with a perseverance which cannot be too highly commended. The results of his experiments are recorded in a series of papers which appeared in Erdmann's *Journal für Technische und Œconomische Chemie*, during the years of 1826-36; and as they are valuable contributions to our agricultural literature, we will point out

the more important of them, and briefly state the theoretical conclusions to which they lead the praiseworthy investigator. Happily he did not confine his experiments to the laboratory, nor to the practical tests of a few flower-pots or a slip of garden land, but conducted them on a large scale in a truly philosophical manner in the field. Although, we believe, he mistook the causes of the advantages of burnt clay, his labours have advanced scientific agriculture in no small degree, and contributed much to the more general application of this valuable manure. They also afford some data to succeeding investigators, who are happier in their conclusions. The result at which Lampadius arrived, by numerous well premeditated and carefully executed experiments, may be briefly thus stated: Properly burnt clay acts on a variety of crops—as on wheat, barley, oats, green crops, and particularly on potatoes—as a most valuable manure. One of his experiments will serve sufficiently for illustration; and without entering into further details, it may be observed that few experiments have recently been recorded which possess more intrinsic value, and that few men were better fitted to submit the alleged effects of burnt clay to a severer test than Lampadius. Not only his extensive theoretical chemical knowledge and practical acquaintance with analysis, but also his acquaintance with practical farm operations, his physiological and meteorological knowledge, his acute talent of observation, adaptation, circumspection, and general skill in devising plans and carrying them out in a truly philosophical spirit, peculiarly fitted him for the task he had undertaken. We thus find him testing the results of the laboratory by experiments on a small scale, and these by others in the field. The physical characters of the soil on which the experiments were made were carefully described, its geological formation on which it rests specified, and its chemical composition ascertained by analysis; the preceding crops, further, grown on it for several years back were noted down. Besides this, the quantity of rain fallen during the season, the temperature, height of the barometer, and general state of the weather, the condition of the crop, from the beginning of the germination of the seed to the period of its maturity, were carefully recorded. The produce, in every case, was ascertained in exact numbers—obtained by means of balance and measure; and lastly, the composition of the produce was determined by analysis, in order to decide the inferiority or superiority of the same crop grown with different manuring substances. In addition to all this, minutes were kept of all the incidents which might have affected the ultimate results; and thus data are supplied which render his experiments valuable for all ages.

The experiment which we shall choose for an example was made on exhausted land, from which, in 1829, a crop of winter rye, and in 1830 and 1831 oats, were grown. The nature and composition of the land was previously ascertained, as well as that of the seed-

potatoes, for it was on potatoes he experimented. The potatoes were planted on the 3d of May 1832.

1. On the first plot of the experimental field, 28 lb. of white potatoes were planted in two rows, and the ground manured with farm-yard manure.

2. On the second, 28 lb. of the same potatoes were planted, and the ground manured with 130 lb. of burnt clay, and the same quantity of manure as that applied on the first plot.

3. The third received 130 lb. of burnt clay only, and the same quantity of potatoes, (28 lb.)

4. On the fourth plot, 28 lb. of the same potatoes were grown without any manure whatever.

The produce was collected on the 27th of September, and gave—

1. 278 lb. of full-grown potatoes, with but few small ones. Some of the larger weighed from 5½ to 6½ ounces; the weight of most was 2 to 3 ounces.

2. 280 lb. of equally good potatoes. Some of the larger weighed 6 to 8 ounces. There were few under 1 ounce.

3. 276 lb. of perfectly matured, very good potatoes. Most were middle-sized, of 3 to 4 ounces weight, with but few small ones.

4. 127 lb. only of potatoes, of a scarcely mediocre quality, mixed with many small ones which had not come to perfection. The plants produced only a few seeds, whereas the potato plants in No. 3. furnished even a greater abundance of seed-apples than those planted in No. 1.

In comparison with the seed-potatoes, the produce of the four plots was therefore—

1. In the field manured with farm-yard manure, ten-fold.
2. In the field manured with farm-yard manure and burnt clay, nearly eleven-fold.
3. In the field manured with burnt clay only, nearly ten-fold.
4. In the field without manure, only a little more than four-fold.

In these experiments, the highly profitable effects of burnt clay on the potato crop, grown on perfectly exhausted land, are exhibited in a most convincing manner.

Passing over the details of the subsequent chemical analyses, to which not only the tuber, but likewise the roots, stem, leaves, and seeds of the potato plants were subjected by Lampadius, the following are the ultimate results at which he arrived:—

a. Burnt clay benefits the growth of potatoes on the poor loam of the neighbourhood of Freiberg nearly as much as mixed animal and vegetable manure, (common farm-yard manure.)

b. The tubers of the potato plants furnish the same quantity of starch, fibre, and water, whether they be grown with farm-yard manure or with burnt clay.

c. The seed-apples, roots, stems, tubers, and leaves of the potato plants, contain the same inorganic constituents, and in the same relative proportions, when grown with burnt clay or with farm-yard manure.

d. The amount of inorganic matters in the different parts of the potato plants differ very considerably.

In order to give an idea of the spirited manner in which Lampadius carried out similar experiments, I would draw the attention of the reader to the fact that, in the same year, this indefatigable philosopher tested the effects of burnt clay on no less than twenty different crops, in a manner which proved forcibly the economic value of this kind of manure. He further caused many farmers to try experiments with burnt clay on a large scale, and had the satisfaction to see his own experiments confirmed by the experience of many practical farmers. So successful, indeed, were nearly all his experiments, and so much the interest of the agricultural community of Germany excited by Lampadius's labours, that, by command of the Government, public establishments were erected

in various parts of the country for the purpose of supplying farmers, at a cheap rate, with properly burnt and finely powdered clay.

The crops which were benefited most by the application of burnt clay, next to potatoes, were ascertained by Lampadius to be peas, kohl-rabi, carrots, beetroot, clover, oats, rye, and wheat. Less favourable he found its use as a top-dressing for pasture land. It is worthy of remark that the good effects of burnt clay were observed on beans, kohl-rabi, and carrots, after the third year, without receiving any additional manure.

Having thus shown on what grounds Lampadius recommended the more general use of burnt clay, we shall now endeavour to collect from his extensive papers the theories he advanced to account for these extraordinary and interesting effects.

At first he appears to be inclined to ascribe to humate of alumina, which according to him is formed in the soil, a highly beneficial action on vegetation, and hints that burnt clay would fail in its effects when the soil was exhausted of humus; but having soon after found that burnt clay in soil destitute of humus produced, nevertheless, unmistakeable effects, he soon gave up this theory, and next explained the effect, by saying that clay in burning undergoes some peculiar unexplained changes, by which changes the manuring substances in clay are rendered available to plants. It will be observed that this explanation amounts to little more than stating the fact in other terms. Indeed, the modified and varied opinions Lampadius entertained afterwards on this subject clearly show how little satisfied he was with this theory. As the probable causes of the effects of burnt clay, he mentions in 1833:—

a. The changes in the state of aggregation clay undergoes in burning.
b. The decomposition of the hydrates occurring in clay.
c. The changes which the earthy substances of the clay undergo in burning, which changes render them more soluble in the humic acids of the soil.
d. The higher state of oxidation of the oxides of iron and manganese produced in burning clay.
e. The production of a larger quantity of soluble sulphates, phosphates, and hydrochlorates, which, previous to burning, occur in a more fixed state in clay.
f. The absorption of light and heat by burnt clay.
g. According to Dr Sprengel, the formation of ammonia in burnt clay.

Several of these opinions were abandoned by Lampadius, who, in 1834, ascribes the effects of burnt clay to the following causes:—

(1.) To the inorganic constituent parts of unburnt and burnt clay, which are essential to the growth of cultivated plants.

(2.) These constituents are rendered more soluble, in various ways, in moderately burnt clay. Unburnt clay gave 0.20 soluble matters; moderately burnt clay, 0.30 soluble salts. Humic acid dissolves likewise silicate of alumina, and the other constituents of clay, more readily when clay has been previously burnt.

(3.) The protoxide of iron in the clay takes up more oxygen in burning, and becomes converted into peroxide, which, according to Sprengel, acts beneficially

on vegetation, whilst protoxide of iron is rather injurious to many vegetables.

(4.) In burnt clay, ammonia is formed when exposed to the atmosphere in a moist state.

In his last concluding paper on this subject, Lampadius advanced finally the following theories :—

a. Plants are supplied by burnt clay with humates of alumina and silica.

b. In burnt clay, exposed to moist atmospheric air, ammonia, which is beneficial to vegetation, is formed according to his own, Sprengel's, and Kersten's observations.

c. According to Zierl, accessory constituents of clay, as phosphoric acid and potash, contribute to the fertilising effects of burnt clay.

These, then, are the theoretical opinions advanced by Lampadius, and we shall see presently how far they are consistent with the present state of science; but, in order to avoid repetition, we shall first briefly state the opinions of others who have written on the subject, and shall then submit the various theories, which all more or less agree with Lampadius, to a short review.

Karl Kersten, who analysed a sample of clay, both in its natural state and burnt, could detect no material difference in the composition of the burnt and the natural clay. The only difference which he points out consists in a slightly greater amount of soluble matter—the amount of soluble substances in the natural clay being 0.20; in the burnt, 0.30. On so small a difference no theoretical speculation can be built, inasmuch as the unavoidable errors in good analyses fall between these limits. Kersten likewise observed the formation of ammonia in burnt clay which had been exposed to the atmosphere for some time, and inclines to ascribe to the latter the chief fertilising effects of burnt clay. No mention is made of the presence of ammonia in the natural clay.

Professor Kastner thinks clay, when burnt, absorbs light, which being given off again in the soil, exercises a beneficial effect on vegetation; but as his theory is founded on no experimental proof, we can dismiss it without any further inquiry into the probability of the explanation he has given.

Dr Sprengel's extensive researches on a multitude of chemico-agricultural subjects—amongst others, on the causes of the beneficial effects of burnt clay—are valuable contributions to scientific agriculture. The theory which he first advanced enjoyed the approbation of many of his contemporaries, and is partly still entertained by no less an authority than Liebig, and other eminent chemists of the present day. This theory is generally called the ammonia-theory. According to it, the chief fertilising agent in burnt clay is ammonia, which Sprengel supposes to be formed in burnt clay under the influence of protoxide of iron, from the elements of water and atmospheric air, and which, according to Liebig and others, exists ready formed in the atmosphere, whence it is simply absorbed by the clay. The clay being more

porous after burning, they suppose absorbs more ammonia, and acts, consequently, more beneficial on vegetation than unburnt.

At first Sprengel attributed the effects of burnt clay to the circumstance that, in burning, the protoxide of iron, existing in many natural clays, is changed into peroxide, which he considers to be more beneficial to vegetation than the protoxide. Sprengel's second explanation entirely contradicts this statement, inasmuch as, according to it, during the burning process the peroxide of iron in clays is changed into protoxide—to which now he ascribes the greatest importance, as being the chief agent in the formation of ammonia in burnt clay; for, in slightly burnt clay, protoxide of iron is always present; and, as it has been ascertained by Hausmann and others, ammonia is formed when protoxide of iron, moistened with water, is kept in contact with nitrogen. Sprengel explains the beneficial action of burnt clay by the formation of ammonia, which is generated in it in the following manner:—The protoxide of iron, of which burnt clay usually contains more than unburnt clay, when exposed to the atmosphere in a moist state, is converted into peroxide by the oxygen of the water; the hydrogen of the decomposed water, in the moment of its liberation, unites with the free nitrogen of the atmosphere to ammonia, which is retained by the humic acids present in all cultivated plants. According to Sprengel's views, the more protoxide of iron clay after burning contains, the more certain it will appear in its effects, because more ammonia will be formed: burnt clay will cease to exhibit the same fertilising effects when all the protoxide of iron has become changed by oxidation into peroxide, because then no more ammonia can be formed. This is the case in overburnt clay, which contains peroxide of iron only, and no protoxide: overburnt clay thus exercises no beneficial effects on vegetation, because no ammonia is formed in it on exposure to the air.

So much for Sprengel's theory. The ammonia, then, which in burnt clay is formed during the oxidation of the protoxide of iron, Sprengel considers as the chief cause of action of burnt clay; at the same time he ascribes to the necessary constituents of clay, as potash, soda, lime, magnesia, &c., some influence in promoting the growth of plants; and agrees likewise with Lampadius's opinion, that humate of alumina, which he considers an important substance in the vegetable processes, is more readily produced in burnt clay than in unburnt.

The recent analyses of the ashes of most cultivated plants have shown the entire absence of alumina in plants; Lampadius and Sprengel's theory concerning the action of humate of alumina, therefore, falls to the ground. That ammonia exists in burnt clay Sprengel has demonstrated, by heating clay, free from organic matters; exposing the same, in a moist state, for three days to the atmosphere; and after that time heating the clay in a retort, to which a receiver was attached, containing water acidulated with

hydrochloric acid. On evaporation of the liquid in the receiver, distinct crystals of sal-ammoniac were left behind in the basin in which the liquid was evaporated. The repetition of this experiment gave me the same result. However, Sprengel erred in thinking that ammonia is formed only in those clays which contain protoxide of iron, for I have found that in clay which contains not a trace of protoxide of iron, ammonia is found after exposure to the atmosphere for some time. It cannot be denied that protoxide of iron, in contact with moisture and atmospheric air, gives rise to the formation of ammonia; but the proof that in burnt clay a greater quantity of ammonia is found, because it contains, as Sprengel supposes, more protoxide of iron, he has not furnished; and his theory loses much in probability, by the consideration that ammonia is found in clay containing only peroxide of iron; and further, that certain blue clays, in their natural state, contain protoxide of iron in preference, with but little peroxide. If it was true that the ammonia is the chief cause of the effects of burnt clay, and that it is formed in clay under the influence of protoxide of iron, from water and atmospheric air, these blue clays ought to possess the same effects as burnt clay, or exhibit even greater fertilising effects than most burnt clays. The contrary, however, is the case. Sprengel appears to have felt the difficulty which presents itself in explaining why certain blue clays, which contain a large quantity of protoxide of iron, do not act so beneficially as burnt clays, containing much less protoxide; and he endeavours to meet it, by a reference to the changes which protoxide of iron undergoes during heating. He says, in unburnt clay, protoxide of iron occurs in a state of hydrate; on burning, it is changed into anhydrous protoxide, in which state it possesses the greatest galvanic energy, in consequence of which a larger decomposition of water, and also more considerable formation of ammonia, results. This explanation, probable as it may appear at first sight, nevertheless wants the only proof on which any explanation can be founded—namely, direct experiment—and amounts, therefore, to nothing more than explaining one difficulty by assuming another. For my own part, I cannot see why anhydrous protoxide of iron should be in a state of greater galvanic energy, and consequently produce more ammonia than the hydrated protoxide; and as Sprengel has not shown, by direct experiment, that this is really the case, the difficulty which presents itself to his ammonia-theory in certain blue clays cannot be said to be removed. We shall see hereafter that ammonia, which is found in burnt clay, indeed contributes to the general effect of the same; but we shall likewise see that it is not the chief cause. The part ammonia plays in producing these effects will be discussed afterwards.

It is now time to allude to the opinions which Professor Zierl entertained respecting the causes of the influence of burnt clay. Unlike Lampadius, Kersten, and Sprengel, he considers the acci-

dental constituents of agricultural clays as the chief causes of the fertilising effects of burnt clay. Without giving any experimental support to his theory, he reasons, with much probability, by analogy, that some of these accessory constituents of clay, particularly potash, soda, lime, and magnesia, are rendered more soluble in the process of burning. To this circumstance he ascribes the chief causes of the effects of burnt clay. It is curious that his theory, set forth with much perspicuity and ingenuity, was by no means generally well received at the time of its publication. Nevertheless, Zierl's theory seems to me the most rational of all the theories which have been advanced. Without a previous knowledge of Zierl's paper, or the causes of the effects of burnt clay, I have formed a theory which, in many respects, agrees with his; and when I shall bring forward the facts by which I hope to support my theory, I shall point out the importance of Professor Zierl's speculations, which, unfortunately for him, were not borne out by any testimony or experiment.

It now remains for me only to say a few words about the opinion which Professor Hermbstädt advanced in a paper, which appeared in *Erdmann's Journal* for 1833, vol. i. p. 45, concerning the effects of burnt clay. His views on the use of inorganic constituents of the soil to plants are so entirely at variance with the generally accepted opinions of chemists and physiologists, that the endeavour to refute them might appear as a waste of words and of time. The same remark applies to his views concerning the effects of burnt clay; and we shall, therefore, only mention, that Professor Hermbstädt refers the active principle of burnt clay entirely to the organic matters which have not been destroyed by the fire. For obvious reasons, he is no advocate of the use of burnt clay; and, although Lampadius's, and many other practical experiments, were published in 1833, he prophesies a total failure to General Beatson's recommendations. Inconsistent as his own views were with the state of science in 1833, he charges General Beatson with ignorance of the first principles of the theory of manures, and this in terms which cannot be too highly deprecated. Ought not his example to make us more charitably inclined towards the opinions of others—more guarded and milder in our expressions, and less confident and dogmatic in propounding our own views?

From these remarks the reader will perceive that none of the above-mentioned theories explains satisfactorily the cause of the decidedly beneficial effects of burnt clay; that Sprengel's, Lampadius's, and Kersten's theory, concerning the use of ammonia, and the modified ammonia-theory of Liebig, are open to serious objections. Furthermore, none explains in the least why certain clays, when properly burnt, act more beneficially than others, and what the reasons are which explain the failures attending the application of over-burnt clay.

Most living agriculturists and agricultural chemists have adopted

Liebig's views respecting the nature of the action of burnt clay, or consider the action to be entirely dependant on the altered physical state which clay after burning presents. Of recent writers on the subject, Professor Johnston, however, entertains much more rational and wider views than any of his predecessors. Giving all due importance to the mechanical effects of burning upon clay, Professor Johnston, in an excellent paper in his *Experimental Agriculture*, p. 254, shows that the mechanical effects of burning upon a clay are insufficient to explain the beneficial action of burnt clay, and demonstrates experimentally that the chemical changes produced in burning are of even a greater importance than the mechanical. "These chemical changes," the learned Professor says, "are of such a kind as to render the constituents of the clay more soluble—that is, soluble to a greater extent than before the burning—both in water and in acids." He further found by analysis, that by over-burning, new changes among the constituents of the clay take place, by which they are again rendered less soluble than when slightly burnt. The soluble matter consisted of potash, soda, lime, magnesia, chlorine, sulphuric acid, silica. The relative proportion of these substances, however, is not stated in the above-mentioned work, from which I infer that the nature of the soluble matters has been examined by Professor Johnston only qualitatively.

By my own experiments, I am enabled to confirm Kersten's and Johnston's observations of the greater solubility of burnt clay, and the observation of Johnston, that clay again becomes less soluble on over-burning. In addition to this, the quantitative analyses of a clay, burnt in three different modes, has given me results which will throw considerable light on the causes of the action of burnt clay. The mere fact that clay becomes more soluble in water and acids, appears to me insufficient to explain the beneficial effects of burnt clay; for it is quite possible that alumina, oxide of iron, or any other unimportant element of clay, of which most soils contain already sufficient quantities, is rendered soluble. It is evident that the greater solubility of any of such substances would increase the quantity of soluble matter, without adding anything to the aggregate fertilising effects of burnt clay. Pure pipe-clay, slightly burnt, is indeed more soluble in acids than the unburnt clay. Sulphuric acid decomposes moderately burnt clay, and dissolves, on boiling, *all* alumina, leaving the silica, with which the latter was combined, behind, whereas concentrated sulphuric acid has but little action on clay in the unburnt state. The greater solubility of burnt clay in itself, then, is insufficient to account for the effects of burnt clay. But this objection stands no longer in our way, since we are in a position to show that, in burning, one of the most important fertilising substances which is found in clay, if not the *most important* of all, is rendered more soluble.*

* Want of space obliges us to postpone the remainder of this interesting paper to the next number.—EDITOR.

CEYLON.

(*Continued from page* 646 *of last volume.*)

We now propose giving a short account of coffee-planting, coffee being one of the chief productions of the island of Ceylon. The priests, and other men of learning among the Cingalese, affirm that coffee is indigenous in the island, and that their ancient records make mention of the natives having made use of a decoction from the berry from time immemorial. However that may be, it is certain that coffee has grown wild on the island from a very early period. So much for what is called native coffee. The cultivated or plantation coffee is said, by more than one author, to have been introduced into the island, early in the eighteenth century, by the Dutch, who caused seedlings to be brought thither from Mocha. But this either wants confirmation, or the cultivation must have been confined to some few small spots; and the generally received belief now is, that it was not until the administration of Sir Edward Barnes, who was made Governor in 1824, that the earliest estates were formed by him and some of the civil servants of Government. It was not, however, till the year 1837 that the cultivation of coffee began to be prosecuted with vigour; but from that period to the present time it has rapidly extended, and the produce has increased, since the year 1840, from about 100,000 cwts. to 250,000 cwts. in 1849.

The quality of the coffee is much improved by cultivation, and plantation coffee brings a much higher price than native; but notwithstanding of this, coffee planting has not generally been found to be a lucrative employment. This is partly owing to the extravagance that has prevailed in forming plantations—an extravagance to which the high price coffee sometimes brings has led; but the price, as well as the quality, being very variable, it is difficult to make any estimate that can be relied on of the return that may be expected. At the time we write, the price varies from 40s. to 72s., according to quality; but it sometimes rises as high as from 60s. to 120s. Coffee must therefore be considered as a speculative article; at the same time, we believe that coffee estates, if formed with economy and conducted with prudence, will make a fair return on an average of years.

Coffee requires a good but not a very rich soil; for if the soil be too rich, the coffee is harsh and coarse. It is grown chiefly in the central provinces of the island, on the slopes of the mountains, and the best qualities are produced at high elevations of from 3000 to 5000 feet above the level of the sea. It is a complete mistake, however, to suppose, as many have done, that the soil on these mountains is rich, for it is generally quite the contrary. It is quite impossible also to ascertain, from the nature of the soil, what may be the chances of success, for it is not uncommon to see two plantations close to each other, one of which is healthy and

beautiful, yielding an abundant harvest, while the other, formed on the same plan, and with the same care, has proved an entire failure, vermin having attacked the roots of the plants, or insects settled on the young shoots, or not unfrequently from some cause quite inexplicable. The earth, too, soon loses its fertile properties, as the coffee plant is not long of exhausting the productive quality of the soil, for which reason planters are now being driven to the use of manure. The vegetable mould, produced by the droppings from the trees of the forests, which for thousands of years have arisen from time to time, and then died a natural death, is in some places very deep, especially in the hollows, where it has accumulated from having been washed down from the rocky ground above. It is difficult to say how long the enriching influence of such a soil may last; but there are some estates, from ten to fifteen years old, which have as yet had no manuring except the rotten pulp of the coffee and the weeds that have grown on the land; while others, not more than five or six, will not continue to thrive without it. About the best manure is the pulp of the coffee itself, mixed with a little lime; but the quantity of manure thus procured is necessarily very limited. All imported manures, such as guano and bone-dust, are, we fear, too expensive to pay. Planters are determined to make the trial, however, and bones have been sent for from New South Wales. One intelligent and enterprising planter intends trying the experiment of putting a few pieces into each hole at the time he plants his new clearing. This description of manure takes a long time to decay, and will continue giving out its virtues for a lengthened period. Upon the whole, there is little doubt that keeping cattle for the sake of their manure is the best plan. This, however, can only be done cheaply by estates which have grass-land adjoining. If grass has to be grown, and the cattle stall-fed, it can scarcely be expected to pay. The cattle also are liable to disease, and suffer from the excessive moisture of the mountain climate, as well as from leeches, which abound in the rainy season. In stiff soil, the manure is applied by digging a trench about a foot deep, in a semicircular form, on the upper side of the tree, and mixing the manure and soil; but on a free soil, and on comparatively flat land, it is sufficient merely to scatter it over the surface. We are inclined to think that people expect a good deal more from manuring than can really be obtained; and we doubt very much if it will pay in any circumstances but those we have already mentioned, where there is pasture for cattle. Thatching the land with grass has been tried, with complete success. It keeps down the weeds for many months, and, gradually decaying, manures the land. But this, of course, can only be done where grass is near and abundant; in which case, independent of the good it may do as manure, it is perhaps cheaper than weeding where the land is foul.

The first process in the forming of a plantation is the clearing

of the jungle, which is both a curious and a novel spectacle to the stranger. The only land found to be suitable is forest land. The first operation is therefore to fell the timber. This is done by notching the trees with hatchets, about half or two-thirds through, near to the ground, beginning at the bottom of the slope to be cleared, and working upwards. When the hewers have arrived at the top of the ground intended to be planted, the highest line of trees is completely felled; and falling upon those immediately below, carry them with a crash to the ground; and the falling mass, increasing in weight and impetus as it descends, rapidly clears the whole extent of the growing forest, previously prepared by the hatchet. This work of destruction is done in the dry season, and the felled timber is then burned and reduced to ashes. After burning, if a good fire has fortunately been obtained, very little lopping is required. The trunks of the trees are merely charred by the fire of the underwood and branches, and are left on the ground that they may prove a shelter from the wind to the young plants; and, decaying by degrees, they enrich the soil. It was formerly the custom to leave large forest trees here and there in coffee plantations, with the view of protection; but it has not been found to answer the end, and is now almost universally discontinued. The fires are tremendous, and present an imposing spectacle among the mountains. If a breeze should spring up, great damage ensues to the neighbouring plantations; and we have known considerable portions of coffee estates set fire to by the flying sparks, and destroyed at least for a season. After the burning of the timber, and the consequent scattering of the ashes, the ground requires no other preparation before planting, which is usually done in the rainy season—the seedlings having either been previously raised in a nursery by the planter himself, or purchased. When all the timber you wish to burn is consumed, you take a long line, marked, say at 6 feet apart, with pieces of white or red cloth, a coolie being stationed at each end of the line, stretching it tight along. A third coolie carries a basketful of pickets, say 18 inches in length; and, at each mark in the line, sticks one of these into the ground. When every mark has had its picket stuck in, the line is moved 6 feet further on, the requisite length having been measured by the coolie at each end, who carries a pole for the purpose; and thus they move on till the whole ground is picketed, as it is called. The coolies are then furnished with a broad large hoe and a crow-bar, pointed at one end, and spade-shaped at the other, and with these they commence holing at each picket. A good size for holes is about 20 inches deep by 18 in diameter; and if the ground is not rocky, a good coolie ought to make from forty to fifty of these in a day. Afterwards, when the rains at the end of May fall—at which time the S.W. monsoon sets in—these holes are filled up loosely with the rich

vegetable soil from the surface at the time of planting, and firmly trod down by the unshod foot of the coolie. A young plantation at this stage is a desolate enough sight; the more so if dry weather follows the planting, when the poor seedlings droop their heads, looking very disconsolate, and causing many anxious thoughts to cross the planter's mind; but with fresh plants newly taken out of the nursery, after they have had a few days' rain, little is to be feared. There is no thinning after planting; but at three or four years the branches touch each other, when the whole ground, especially in March when the blossom comes out, presents a most beautiful appearance. The blossom is very much like the flower of the jasmine, having five petals, and the colour white. During the years before the coffee-bush bears, there is little pruning, except by the hand, such as plucking the suckers off, which a vigorous plant throws out in great quantities near the top. The leaf of the coffee bush is of a dark rich green, and as like as can well be imagined to the laurel leaf. It is perhaps the most symmetrical of trees—some might think formal, two branches springing from the stem directly opposite each other, and again other two at right angles to these, and always at equal distances from each other, the branches being quite straight, and inclining upwards, and becoming shorter, as a matter of course, as they approach towards the top of the stem. Just before the picking season, when the whole bush is clothed with the richest green foliage, when the fruit is ripe and pulpy like the cherry, which it exactly resembles both in colour and size—and is, indeed, in this state called cherry coffee—the sight is one of extreme beauty, and well worth witnessing. An estate ought to be weeded once a month, especially till the coffee gets well up and covers the ground, after which it is not of so much consequence, for the weeds will not come up so fast in the shade. Weeding is a heavy item in the expense, but it varies very much in different estates. Some have reduced it as low as £1 a-year per acre, while others pay as high as £3. For, in a moist and hot climate like Ceylon, the swiftness of vegetation is such as can scarcely be believed by those who have not witnessed it. If the weeds are allowed to blossom or flower, every puff of air blows the ripened seed on its wings; and the seed of the worst species of weed known there being somewhat analagous to our thistle down, but much finer and more minute, and each weed producing more seeds than can be numbered, the foul state a plantation gets into may be imagined, when from some cause, such as coolies running away at your time of need, or your not being able to procure them when required, this state of matters has continued for a few months, seeing that about six weeks are sufficient to bring these weeds to a state of dangerous ripeness.

The height to which a tree should be allowed to grow depends chiefly on the distance at which they are planted, the quality of

the soil, and their exposure to wind. In no case, in the most favourable circumstances, is it advisable to let the trees grow beyond 4½ feet; and if not closely planted, nor in very good soil, 3½ feet is the best height. As a matter of course, if trees are topped low, they spread out and cover more ground. Where trees are not at all exposed to wind, the preferable plan is to let them grow pretty high above the intended height before topping; for this reason, that it tends to diminish the first crop; for, although many people think it the very acme of good planting to get a heavy first crop, it has been proved by experience that this produces a most unfavourable effect on the trees for the two following years, and even in some cases permanently. Another reason is, that the stem is less likely to split, if cut where pretty strong, than if merely the green top shoot is taken off. Where the plant has suffered severely from wind, it has been found necessary to cut it as low as 2½ or even 2 feet; but this has an injurious effect on the productiveness of the tree, and can never be remedied, as has been tried, by allowing a shoot to grow up afterwards. These shoots grow luxuriantly, bear one crop, and rarely do any good afterwards, many of them dying off. We know of one estate on which shoots were allowed to grow up thus on some of the best trees, but it was found necessary afterwards to saw them all off; and the same has been tried, but with equally bad consequences, on other estates besides. As the soil of Ceylon in general is not rich, we are inclined to think, after much inquiry, that planting 6 feet each way apart, and topping the trees at 3½ feet, may be laid down as the most profitable method as a general rule, but from which, of course, many deviations would be rendered advisable by circumstances. Any tree that, at the age of four years, looks bare and poor, should have 6 inches or a foot cut off it, whatever its previous height may have been, and particularly if it cannot be manured.

The two straight branches which grow directly opposite each other, from each knot in the stem, obtain the name of primaries. These again throw out in the same way secondaries, but often more than two, frequently five or six at each knot or eye. These, when too numerous, ought to be pulled off as young as possible, leaving one or two, choosing of course the strongest. It is of the very greatest importance to take off, when young, all the secondaries that grow within 6 or 8 inches of the stem; thus leaving a clear space for the sun and the air to penetrate and circulate, and allowing the primaries to spread out strong and long. Almost all the first crop is borne on the primaries, and all the subsequent ones on wood grown upon them. From this simple fact the importance of good primaries will be seen. They should be cut as little as possible; and when they show at the top signs of decay, it is enough to take off a few inches, cutting off one eye at the knot where you cut, and cultivating one secondary branch

from the remaining eye, which will thus take the direction and place, in some measure, of a decaying primary. But if a primary should be broken near the stem, it will be found necessary to grow a branch to supply its place from the last secondary, which must be cut off at the knot from which the future leading branch springs. Coffee is all borne upon the young wood, the same branch never bearing twice; at least if the first part bears, the tip only bears next year. Tertiaries, if grown in large numbers, choke up the tree; therefore pruning may be reduced to one general rule, to take the crop from the alternate secondaries. The branch that has borne twice being cut close off after crop, the opposite branch bears next year. Many estates in good soil have gone on bearing, year after year, very good crops without being pruned at all; but afterwards it is always found necessary to make a clean sweep of all the old wood, leaving only the bare primaries, and to sacrifice one, if not two years' whole crop. All dead wood should be cut off, cutting back till you come to the part of the branch that is still alive. There is no subject on which a greater diversity of opinion exists than on pruning, and some may consider the above as carried to excess; but you may meet with fifty planters, and find that not two of them can agree on this knotty point.

Ceylon being subject to very heavy gales, destruction from this cause may be remedied to a great extent by judicious staking. The best mode is to cut a moderately thick stake, a little higher than the tree; stick it firmly in the ground, sloping it against the wind, so as to come in contact with the top of the tree which is to be tied to it. Many people foolishly enough stick in the stake perpendicularly close to the stem of the tree, and tie them together six or eight inches from the ground. This rather does harm than good, as the tree is blown about almost as much as before, and the bark is worn off by the constant chafing of the string with which it is tied. In choosing land, it is almost impossible to tell whether it will suffer from wind or not after the forest is cleared; but if you see the tops of the forest trees taking a decided bend in one direction, you may be certain that the coffee will suffer.

The duration of the coffee-tree is a point which cannot be spoken of with any certainty from positive experience derived from Ceylon plantations. There are numerous estates planted on very bad soil, or much neglected, which have gone out after yielding two, three, or four crops. On the other hand, some of the very best coffee in Ceylon is the oldest. There are about 70 acres of coffee on an estate not far from Kandy, which are thirteen years old, and yet not showing the slightest symptoms of falling off. We understand that Laborie states, in his rare and valuable work on coffee culture,—a work written sixty years ago, and applying to the West Indies alone, but reprinted some years ago in Ceylon for the use of the planters, from the single copy to be found in the island, and which is still regarded by all planters everywhere as the best

authority on the subject,—that in the West Indies thirty years were spoken of as the average duration; but he gives it as his own opinion, that, with care in replacing decayed trees, manuring, &c., an estate might be carried on much longer. We never hear of native coffee dying out, although a great deal of it is much older than thirty years. It is grown in the shade, closely planted, and never pruned at all; so that it is quite common to see these trees attain to the height of 20 feet, and even upwards. There is a very valuable plantation called Hougran Kette, formerly the property of the Kandian kings, but now belonging to a native Headman, who tried the experiment of cutting down the forest trees which shaded the coffee. The experiment, which luckily was on a small scale, failed completely, most of the coffee dying. There is little doubt that if native coffee were properly picked and cured, it would be found nearly equal to the average of plantation, but they pick it all at once, ripe or unripe; dry it in the cherry; do not seem to mind its getting a few showers of rain after being partially dried; and, to crown all, clean it as they do paddy, by pounding it in a wooden machine like a mortar, with a heavy pestle. This breaks the beans, and they get discoloured and irregular in the extreme. The quantity of native coffee has decreased seriously of late, which has not been satisfactorily accounted for, as the prices have been remunerative. The bug no doubt partly accounts for the defalcation. Intelligent natives, who have good opportunities of judging, when questioned on the subject, which they frequently are, always reply that there is no appearance of the trees failing. When prices were low, a good deal of native coffee was lost from neglect, it having been allowed to fall off the trees.

The picking in all the high-lying districts begins towards the end of September, the busiest time coming on in November; and the whole picking or crop season may be said to be over about the end of January; in the lower districts, of course earlier. A coolie ought to pick from two to three bushels of cherry coffee in a day. It takes about eleven bushels of cherry to make 1 cwt. of clean marketable coffee. Coolies are rather inclined to be troublesome during picking season, especially when labour is scarce. Crimping is carried to a great extent at such times, and they are often lured away by the promise of higher pay obtainable at other estates. It is advisable to keep them in arrears at this season; but in spite of all precautions, planters not seldom find that a gang of thirty have made a moonlight flitting of it. Some planters are becoming alarmists as to their prospects of an adequate supply of labour. Notwithstanding of this year's crop having proved short, coolies were rather scarce, in spite of an unusual number of Cingelese having come to work. This is a fact, and an unpleasant one. After paying his expenses, a coolie can save very little money out of his three or four months' pay

during the picking season. It will be a serious matter for planters if they are driven to raise their wages.

When the coffee is picked, it is carried in baskets to the pulping house, and emptied out on the floor of what is called the cherry loft. A stream of water is conducted into a hole on the floor of this loft; the cherry coffee falls, or is pushed into the same hole, and then falls into the hopper of the pulper, a machine something like a fanner. When it reaches the lower part of the hopper, it passes between what is called the chop and the round barrel of the machine, which is covered with a sheet of punched copper, not unlike a large nutmeg grater; and, as this grater revolves, the husks are taken off, falling back behind the machine, while the coffee is carried by the stream of water down upon a sieve, which also receives its motion from the machine, and thence into the fermenting cistern. If the weather be warm, the fermentation will go on rapidly, and, on the following morning, the mucous matter in which the coffee is encased will readily come away. If it be found in this desired state, it is worked about with flat wooden rakes and the feet of the coolies, a plentiful supply of water being kept running upon it; it is then allowed to flow into the adjoining cistern, where it is ranged through and through in clean water until it is nearly as white as ivory, when it is carried out of the cistern and laid upon the barbecuse or drying ground, which is quite open, put into the store in the evening, and brought out again next morning to dry. It takes about eight days of bright sunshine to dry the coffee sufficiently to enable it to stand the journey to Colombo, where there is no lack of sunshine.

The quantity of rain, and the extreme variableness of the weather, rendering it difficult to dry coffee, several planters during the last year have been putting up stores with drying machines. This plan, which was invented by a Mr Clerihew, a planter, has proved completely successful; and although expensive at first, is yet likely to be generally adopted. The store being made tight, air, heated by passing through large iron pipes carried through a furnace, is introduced, and a strong draught kept up by screws, or a fanner driven by a small water-wheel. The floors are prepared with narrow reapers or thin pieces of wood placed across the beams, thus leaving a free passage for the current of warm dry air, which is a very judicious treatment, as the coffee is thereby entirely preserved from the danger of heating to which it is exposed when placed on an ordinary floor, for in damp weather it is impracticable to put it out of doors to dry. The coffee is placed on these narrow reapers, being spread out on gunny cloth, a coarse sacking, of which bags are made for all kinds of Eastern produce. It is principally brought from Bengal, and is used for carrying down the coffee to Colombo, and also to pack it for shipment to this country. In a store such as we have described, four or five days drying would be sufficient before despatching it to Colombo. A

store suitable for a moderate-sized estate, with drying machines complete, may be built for about £500. The beautiful iron wood tree of these forest trees, the satin wood, the Keena Doom, and many others, which would bring a high price in this country, is used in the fitting up of the stores, one of which is described as almost entirely floored and boarded with satin wood, and covered with a corrugated galvanised iron roof. It is 120 feet long by 38 broad, which is large enough for an estate of 200 or 250 acres.

From some estates the coffee is carried on the heads of the coolies as far as twenty miles before a bandy road is reached. The danger to all sorts of produce from rain and bad roads by these bandies we have already described. When the coffee is sent off from the estates, it is called parchment coffee; and on its arrival in Colombo, it is subjected to a further process of drying. It has still two skins remaining upon it; the parchment skin, so called from its resemblance in colour and thickness to parchment; and the silver skin, a thin pellicle, which sometimes adheres more tenaciously to the coffee than planters would desire. These are peeled off by a machine called a peeler, which is a large solid wooden wheel that revolves in a circular trough. The whole process of receiving, peeling, curing, sizing, and packing, costs in casks 5s. a cwt., and in bags 4s. A ton in casks as well as in bags is reckoned at less than the real ton, the former being 16 cwts., and the latter 18 cwts. In paying freight from Ceylon, the above is the allowance recognised by all parties concerned. Though casks are thus in every way a more expensive package, still shippers prefer them, as a current of air plays through the spaces between them on a long voyage, and prevents heating, which coffee in bags is liable to. Besides, few things imbibe moisture more readily than coffee; and if sugar is stowed in the hold of a vessel with the bean, the coffee has the best chance in casks. Coffee in bags is also very often damaged in the boats on its way off to the ship, Colombo being an open roadstead, and sometimes rough. The present freight from Colombo is £3, 10s. a ton.

The expense of cultivation was very different from what it is now, in the time of Sir Edward Barnes, when the earliest estates were formed by him and other civilians, who possessed many advantages arising from their influential position and the cheap rate at which labour could then be obtained, so that estates were at that time brought into bearing at a very reasonable cost. Their earliest crops sold at nearly £5 per cwt.; so that it can hardly be a matter of surprise that, when this result became known, a mania for coffee planting in Ceylon ensued. It was subsequently found expedient by Government to quadruple the price of land, which was done after Sir Colin Campbell was made governor in 1841, by raising it from 5s. to £1, but which did not act as the slightest check. But labour became scarce, and more expensive; the price of coffee fell; money also became scarce, and the interest on loans

high; and, without exaggeration, in 1848 three-fourths of the planters were insolvent; many being ruined by the foreclosing of mortgages on their estates, consequent on the commercial difficulties. Many estates had cost £60 to £100 per acre, and planted land was actually sold at £100 per acre. At length came the great reverse, and a very large proportion of the coffee estates changed hands at mere nominal prices, being bought in by the mortgagees. We have heard that fifteen estates were sold for £1100. Neglect of the soil, from scarcity of money, was sufficiently evident from the great shortcoming in the last crop, which has been reckoned at 30 per cent. The improvement in the market eighteen months ago, however, did a good deal to remedy this. People all took to clearing up abandoned or neglected estates; and the coming crop is expected at least to equal that of 1849. We know of some estates near Kandy, in first rate order, favourably situated, and producing a good middling quality of coffee, whose proprietors consider that they have no other fault but that of being too small; and that if 70 or 80 acres in addition were brought into bearing with the strictest attention to economy, the crop would be very nearly doubled; it would be produced at a much cheaper rate overhead; and even supposing the price only to average 50s., make the new field profitable.

There is understood to be very little good forest land now in the hands of Government, but there is a great deal in the hands of private parties which might be purchased at £3 or £4 per acre; and in spite of all we have said in condemnation of over sanguine speculations, we cannot but admit that an estate of say 200 acres, planted and managed by the proprietor, is still a fair investment for money. He could bring this extent into bearing in the very best style, including living comfortably himself, and good stores and other buildings, for £5000—possibly less. Nothing varies more than crops; but take 5 cwt. per acre, he would bring 1000 cwts. into the London market at 40s., including, as before, his own expenses; and if this coffee sold at only 50s., he would have £500 clear. This could hardly be considered a bad return. Supposing the coffee to sell at 60s., which would yield £1000 per annum, this is a large return for £5000 invested, and would repay the whole in five crops, without, however, calculating interest. But no prudent planter would *now* calculate on such a return. He would take into account such contingencies as the blight, which, on some estates, has been so bad as to lessen the production to a half for three consecutive years. The latest reports say that it is not so bad as it was, but few estates have altogether escaped. There is no cure yet been discovered. There are some estates which, beyond all doubt, have yielded 15, or even 17 cwts. per acre in one year; but we are very doubtful if there is any estate that averaged 10 cwts. for three years consecutively.

The annual expense of raising and preparing coffee, and sending

it to London, may be stated at from 30s. to 40s. per cwt; and it is only the difference between these prices, and what it may bring when sold, that affords a return to the planter. As his estate will probably have cost him from £30 to £40 per acre, including buildings and machinery, also interest of outlay for three years before the land yields a crop, and as he cannot calculate on an average crop of more than 5 cwt. per acre, it is plain that his profits will not be large, unless he obtain more than 60s. per cwt., which is above the average price for some years. We have seen many very erroneous statements as to the expense of forming a coffee estate, which being calculated to mislead, we deem it right to correct. As a specimen, we may quote a few lines from Sirr's *Ceylon and the Cingalese*, where he says—"The expense of clearing jungle and forming it into a coffee estate, has been calculated at £8 per acre." This we think is, to say the least of it, a loose way of stating the matter; because, we presume, it is only meant to apply to the expense of clearing and planting—although even for this it is too small a computation—and does not include the price of the land, the interest on outlay before the first crop, the expense of weeding for the same period, new buildings, machinery, &c.; all which included, the amount will be about four times what is here set down.

Now that, by sad, and many of them by ruinous experience, planters in Ceylon have awakened from their wild dreams of success—dreams almost as wild as any South Sea scheme or bubble railway gave rise to, we feel that few, if any of them, will be disposed to quarrel with our plain unvarnished statements. We have given the most favourable view of the matter when describing what we think may still be called a fair investment for money. But many contingencies, such as the ravages of the bug and other insects, blight, exhaustion of the soil, and fluctuation of prices, must be taken into account, as ever tending greatly to reduce the calculated profits. To all these risks must be added that of climate, which, although certainly good in Ceylon for an Oriental country, is still a trying one. Sooner or later almost all Europeans suffer from it. If their health is not attacked on first going out, and they are thus induced to boast of their own strength, or to wonder how any one could call it a dangerous climate, they too often find that their constitutions have been secretly undermined, and that they must hurry off to their native air while yet their strength serves them. Expatriation to a tropical climate, too, will ever be regarded by the many as an evil not to be compensated for by profits much greater than those we have held out. In looking back to the vain boastings that sometimes met our ears ten years ago, we cannot help feeling some small, and it may be pardonable, degree of self-complacency; for we were almost as incredulous then as we are now. A small estate of 200 acres was to yield, the very first crop, a return of £1000; then the second year £2000; by a little additional

planting it was to rise to £5000; and then to £10,000. And where was it to end? was the triumphant question by which all these vain boastings were wound up. For all such wild dreamers the page of history has opened its treasures in vain, and it were equally vain for us to try to persuade and enlighten them.

Till now, coffee grown in British colonies has been protected by a differential duty of 2d. per lb.; but within a few weeks this has ceased, and foreign and British colonial coffee now pay the same duty of 3d. per lb. It remains to be seen whether this will injure Ceylon planters. The general feeling among them, we believe, is, that it will not, as Ceylon already raises more coffee than is consumed at home, and part has to be sent to foreign countries.

FIARS PRICES of the different COUNTIES of SCOTLAND, for Crop and Year 1850, by the Imperial Measure.

ABERDEEN.

	Imp. qr.
Wheat, without fodder	35/5
—— with fodder -	
Barley, without fodder	23/2
—— with fodder -	30/2
Bere, First, without fod.	21/
—— with fodder	28/
—— Second, without fod.	20/
—— with fodder	27/
Oats, Potato, without fod.	15/6
—— with fodder	25/0
— Common, without fod.	14/6
—— with fodder	24/
Pease - - - - -	24/9
Beans - - - - -	22/
Malt - - - - -	41/6
Oatmeal, per 140 lb. -	12/

ARGYLE.

Wheat - - - - -	36/8
Barley - - - - -	22/8
Bere - - - - -	19/4
Oats - - - - -	16/8
Beans - - - - -	23/2
Oatmeal, per 140 lb. -	13/2

AYR.

Wheat - - - - -	36/1
Barley - - - - -	21/3½
Bere - - - - -	19/5
Oats - - - - -	14/1½
Pease - - - - -	27/6
Beans - - - - -	28/7½
Oatmeal, per 140 lb. -	12/8½

BANFF.

Wheat - - - -	39/10
Barley, without fodder -	21/4
—— with fodder -	26/4
Bere, without fodder, -	18/6
—— with fodder - -	23/6
Oats, Potato, without fod.	15/9
—— with fodder	23/3
— Common, without fod.	15/2
—— with fodder	22/8
Beans - - - - -	25/0
Pease - - - - -	25/
Rye - - - - -	
Oatmeal, per 140 lb. -	11/5

BERWICK.

	Imp. qr.
Wheat - - -	35/9$\frac{4}{12}$
Barley, Merse -	21/8$\frac{5}{12}$
—— Lammermuir	20/11$\frac{6}{12}$
Oats, Merse - -	17/7$\frac{4}{12}$
—— Lammermuir	16/9$\frac{9}{12}$
Pease - - -	26/7$\frac{6}{12}$
Oatmeal, per 140 lb.	13/4

BUTE.

Wheat - - - - -	35/5½
Barley - - - - -	20/8¾
Bere - - - - -	17/7
Oats - - - - -	17/3¼
Beans - - - - -	26/7
Pease - - - - -	
Oatmeal, per 140 lb. -	13/

CAITHNESS.

Barley - - - - -	18/2
Bere - - - - -	17/11¾
Oats, Angus and Sandy	13/10¾
—— Hopetoun & Potato	
Oatmeal, per 140 lb. -	11/9½

CLACKMANNAN.

Wheat - - - - -	36/5
Barley, Kerse - -	22/9¾
—— Dryfield - -	22/1½
Oats, Kerse - - -	17/4¾
—— Dryfield - -	16/8¾
Pease and Beans - -	26/6¾
Malt - - - - -	45/0¾
Oatmeal, per 140 lb. -	13/9¾

DUMBARTON.

Wheat - - - - -	37/5
Barley - - - - -	22/8
Bere - - - - -	20/8
Oats - - - - -	17/4
Pease and Beans - -	28/10
Oatmeal, per 140 lb. -	14/1

DUMFRIES.

	Imp. qr.
Wheat - - - - -	38/8
Barley - - - - -	23/0
Bere - - - - -	20/8
Oats, Potato - - -	15/10
—— White - - -	14/10
Rye - - - - -	32/0
Pease - - - - -	
Beans - - - - -	30/10
Malt - - - - -	56/6
Oatmeal, per 140 lb. -	12/11

EDINBURGH.

Wheat, First - -	36/4
—— Second - -	33/
Barley, First - -	24/8
—— Second - -	22/
—— Third - -	20/6
Oats, First - - -	18/0
—— Second - -	16/6
Pease and Beans - -	27/7
Oatmeal, per 112 lb. -	10/8
—— 280 lb. -	26/8

ELGIN AND MORAY.

Wheat - - - - -	38/8
Barley - - - - -	22/8
Oats - - - - -	16/2
Rye - - - - -	21/
Pease and Beans - -	
Oatmeal, per 112 lb. -	10/9

FIFE.

Wheat, White - -	36/2½
—— Red - -	31/11¾
Barley - - - - -	21/3¾
Bere - - - - -	19/3¾
Oats - - - - -	16/5½
Rye - - - - -	23/0½
Pease and Beans - -	22/7¾
Malt - - - - -	45/11¾
Oatmeal, per 112 lb. -	10/8
—— 280 lb. -	26/7¾

FORFAR.

Wheat - - - - -	36/6
Barley - - - - -	20/9
Bere - - - - -	20/7
Oats, Potato - -	16/9
—— Common - -	15/8
Rye - - - - -	
Pease and Beans - -	23/3
Oatmeal, per 140 lb. -	13/4

HADDINGTON.

Wheat, First - -	41/10¾
—— Second - -	39/8¾
—— Third - -	37/1¾
Barley, First - -	27/1

FIARS PRICES—*Continued.*

HADDINGTON (*Continued.*)

	Imp. qr.
Barley, Second	25/9½
—— Third	24/3¼
Oats, First	20/9¼
—— Second	19/6¾
—— Third	18/6

INVERNESS.

Wheat, without fodder	37/8
—— with fodder	43/8
Barley, without fodder	21/2
—— with fodder	25/8
Bere, without fodder	19/4
—— with fodder	23/10
Oats, without fodder	16/0¼
—— with fodder	22/0¼
Oatmeal, per 112 lb.	11/4½

KINCARDINE.

Wheat, without fodder	35/7
—— with fodder	45/7
Barley, without fodder	21/6
—— with fodder	29/6
Bere, without fodder	19/10
—— with fodder	27/10
Oats, Potato, without fod.	16/5¼
—— with fodder	25/5¼
—— Common, without fod.	15/1½
—— —— with fod.	24/1¼
Pease, without fodder	22/11½
—— with fodder	30/11½
Beans, without fodder	22/11¼
—— with fodder	30/11¼
Oatmeal, per 140 lb.	13/2¼

KINROSS.

Wheat	30/8
Barley, First	22/4
—— Second	19/10
Oats, First	16/3
—— Second	14/11
—— Average	15/7
Pease	24/6
Oatmeal, per 280 lb.	26/

KIRKCUDBRIGHT.

Wheat	38/4
Barley	23/2
Oats, Potato	16/
—— Common	14/8
Oatmeal, per 140 lb.	12/3½

LANARK.

Wheat, First	37/6
—— Second	33/8$\frac{8}{12}$
Barley, First	22/4$\frac{2}{12}$
—— Second	22/1$\frac{6}{12}$
Bere, First	21/8$\frac{4}{12}$
—— Second	
Oats, First	17/4
—— Second	15/2$\frac{8}{12}$
Beans	29/9$\frac{6}{12}$
Pease	28/3$\frac{6}{12}$
Malt	48/0
Oatmeal, First, per 140 lb.	13/7$\frac{4}{12}$
—— Second	12/3$\frac{4}{12}$

LINLITHGOW.

	Imp. qr.
Wheat	36/10
Barley	24/2
Oats	17/2
Pease and Beans	27/7
Malt	45/10
Oatmeal, per 112 lb.	10/9½
—— 140 lb.	13/5

NAIRN.

Wheat	38/6
Barley, without fodder	21/7
—— with fodder	26/6
Oats, without fodder	16/6
—— with fodder	22/6
Oatmeal, per 112 lb.	10/8

ORKNEY.

Bere, per 360 lb.	13/3
Malt, per 140 lb., with duty	15/8
—— per 140 lb., without duty	7/8
Oatmeal, per 140 lb.	10/6

PEEBLES.

Wheat, First	41/
—— Second	40/0¾
—— Third	40/
Barley, First	23/2
—— Second	21/4¾
—— Third	19/10½
Oats, First	16/5
—— Second	15/0½
—— Third	13/10
Pease and Beans, First	30/7¾
—— —— Second	29/3¾
—— —— Third	27/7¾
Oatmeal, per 140 lb. First	12/7
—— —— Second	12/2½
—— —— Third	11/9¾

PERTH.

Wheat, First	36/6
—— Second	29/
Barley, First	21/5
—— Second	16/9
Oats, First	16/2½
—— Second	13/4
Rye	21/9
Pease and Beans	23/11
Oatmeal, per 140 lb.	13/6

RENFREW.

Wheat, First	37/4¼
—— Second	37/0
Barley, First	24/2¼
—— Second	23/0¼
Bere, First	23/6¾
—— Second	22/3¼
Oats, First	17/7
—— Second	16/8¼
Beans, First	29/4
—— Second	29/3¼
Pease, First	29/
—— Second	
Oatmeal, per 140 lb. First	13/6
—— Second	13/4¼

ROSS AND CROMARTY.

	Imp. qr.
Wheat, First	37/4¼
—— Second	34/6¼
Barley	21/10½
Bere	20/3
Oats, First	17/2
—— Second	15/5¼
Pease	28/
Beans	25/4
Malt	
Oatmeal, per 140 lb.	13/1
Barley, ——	8/10

ROXBURGH.

Wheat	36/6$\frac{6}{12}$
Barley	21/8$\frac{5}{12}$
Oats	17/4$\frac{5}{12}$
Rye	
Pease	26/7$\frac{4}{12}$
Beans	26/7$\frac{4}{12}$
Oatmeal, per 140 lb.	13/1$\frac{6}{12}$

SELKIRK.

Wheat	37/4
Barley	22/
Oats, Potato	18/
—— Common	16/8
Pease	27/8
Oatmeal, per 280 lb.	25/8

STIRLING.

Wheat	35/4
Barley, Kerse	22/8
—— Dryfield	20/10½
Oats, Kerse,	17/1
—— Dryfield	16/
—— Muirland	14/
Beans	26/4
Malt	44/
Oatmeal, per 140 lb.	13/4

SUTHERLAND.

Wheat	39/6
Barley	21/7
Bere	16/6
Oats	18/
Pease	29/4
Beans	26/6
Oatmeal, per 140 lb.	14/8

WIGTOWN.

Wheat	35/6
Barley	20/10
Bere	18/4
Oats, Potato	15/8
—— Common	14/
Rye	18/8
Pease	
Beans	25/2
Malt	60/
Oatmeal, per 280 lb.	25/

We may inform our English readers, that Fiars Prices are the average prices of grain, as ascertained every year, by the verdict of Juries, in every County of Scotland. The Juries are summoned in spring, and ascertain from the evidence produced to them, the average prices of the preceding crop. By these prices, rents payable in grain, and similar contracts, are generally determined; but the main object is to convert into money the stipends (for the most part fixed at a certain quantity of grain) of the Scottish Clergy.

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Feb. 8.	41	11	26	1	17	7	25	0	27	5	25	3
15.	41	2	24	1	17	1	26	0	29	0	24	6
22.	40	1	24	1	16	6	22	6	29	8	25	5
Mar. 1.	39	10	24	0	17	0	22	10	26	2	24	7
8.	39	8	23	11	17	8	23	6	27	4	24	11
15.	41	10	23	6	17	6	23	0	26	0	24	8
22.	40	6	25	11	17	5	23	2	25	4	26	7
29.	42	9	23	8	16	7	23	4	23	7	25	4
Apr. 5.	43	3	26	1	17	2	24	2	24	1	24	5
12.	43	6	25	11	17	10	25	0	25	7	25	0
19.	43	5	25	4	17	6	25	0	27	4	24	8
26.	42	4	26	1	18	3	24	6	24	5	24	10
May 3.	42	2	25	0	18	0	24	6	24	9	25	9
10.	41	9	25	7	19	1	24	4	25	7	26	0
17.	41	7	25	0	18	11	24	0	27	1	25	5
24.	41	0	23	10	19	2	23	10	25	5	26	1
31.	42	1	25	3	19	5	24	1	27	1	27	11

EDINBURGH.

Date.	Wheat.		Barley.		Oats.		Pease.		Beans.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Feb. 5.	38	4	24	5	18	3	27	6	28	0
12.	36	11	24	8	18	1	28	0	28	6
19.	36	10	25	7	18	4	27	9	28	3
26.	37	4	25	5	19	7	28	0	28	4
Mar. 5.	38	5	26	1	20	0	28	6	29	6
12.	38	6	28	7	20	10	28	0	28	7
19.	39	10	28	4	20	8	27	6	28	2
26.	40	0	28	0	20	1	28	0	28	6
Apr. 2.	39	4	26	5	20	5	28	2	28	8
9.	39	9	27	1	21	5	29	1	29	7
16.	40	6	28	0	21	9	30	2	30	10
23.	40	9	27	1	21	5	29	1	29	8
30.	39	7	27	8	20	9	29	2	29	8
May 7.	39	4	29	1	21	1	29	2	29	9
14.	39	11	29	10	21	11	29	8	31	1
21.	40	7	29	3	22	2	31	6	32	5
28.	41	1	28	3	22	11	32	6	33	7

LIVERPOOL.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Feb. 8.	40	2	23	7	18	7	23	9	27	6	27	4
15.	38	8	25	10	18	5	24	6	26	9	27	8
22.	37	2	25	8	17	6	23	9	26	6	26	8
Mar. 1.	39	11	24	10	17	1	23	6	25	10	25	3
8.	39	7	25	6	16	0	22	8	25	4	26	5
15.	39	4	25	7	16	7	22	6	24	0	27	0
22.	38	2	24	2	16	3	23	0	24	6	27	6
29.	39	5	25	10	17	7	23	4	24	2	26	7
Apr. 5.	39	8	24	9	20	3	23	9	24	8	27	0
12.	41	10	26	0	18	3	24	2	25	6	28	0
19.	39	5	22	9	17	8	24	6	25	5	28	3
26.	41	4	24	7	18	7	25	0	25	1	28	11
May 3.	39	2	24	1	22	9	24	8	25	6	29	11
10.	39	8	24	9	20	2	24	4	26	6	30	0
17.	39	3	24	7	18	8	23	10	26	10	31	0
24.	41	7	24	10	19	10	23	6	25	8	31	3
31.	41	2	25	6	22	6	23	11	26	6	30	1

DUBLIN.

Date.	Wheat, p. barl. 20 st.		Barley, p. barl. 16 st.		Bere, p. barl. 17 st.		Oats, p. barl. 14 st.		Flour, p. barl. 9 st.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Feb. 7.	22	1	13	3	10	6	9	7	14	4
14.	21	11	13	0	10	2	9	5	14	6
21.	22	11	12	10	10	1	9	9	14	8
28.	22	9	12	8	9	10	9	7	14	9
Mar. 7.	22	6	13	6	10	8	9	10	14	8
14.	22	2	14	0	11	6	10	2	14	8
21.	21	0	13	9	11	4	10	4	14	4
28.	21	4	13	10	11	6	10	6	14	3
Apr. 4.	21	8	14	1	12	2	10	8	14	2
11.	22	2	14	4	12	6	10	10	14	2
18.	22	9	14	8	12	7	11	5	14	1
25.	23	7	14	10	12	6	11	9	14	1
May 2.	23	2	14	11	12	4	11	7	14	5
9.	22	6	15	2	12	7	11	4	14	4
16.	22	0	15	4	12	8	11	8	14	4
23.	23	5	15	6	13	6	12	3	14	2
30.	23	1	15	10	13	4	12	4	14	1

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vic., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.				Barley.				Oats.				Rye.				Pease.				Beans.			
	Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Feb. 8.	38	1	38	0	22	10	22	10	16	9	16	9	23	11	23	11	26	0	27	0	25	10	26	5
15.	37	8	37	11	22	11	22	9	16	2	16	8	23	10	23	4	26	10	26	9	25	2	26	2
22.	37	2	37	9	22	10	22	9	15	11	16	5	23	8	23	8	27	1	26	9	25	4	25	11
Mar. 1.	36	11	37	7	22	7	22	9	16	0	16	4	24	4	23	7	25	8	26	7	25	3	25	8
8.	36	9	37	5	22	7	22	9	16	2	16	3	24	4	23	9	26	7	26	5	25	7	25	7
15.	37	2	37	3	23	1	22	10	16	6	16	3	23	3	23	11	25	8	26	4	25	0	25	6
22.	37	5	37	2	23	3	22	11	16	9	16	3	22	8	23	8	25	9	26	3	25	8	25	6
29.	38	1	37	3	23	7	23	0	16	7	16	4	28	5	24	5	24	6	25	10	25	7	25	6
Apr. 5.	38	4	37	5	23	10	23	2	17	0	16	6	23	11	24	6	24	8	25	6	25	11	25	7
12.	39	0	37	9	24	2	23	5	17	5	16	9	24	7	24	6	25	6	25	5	26	4	25	9
19.	39	5	38	3	24	5	23	9	17	5	16	11	24	7	24	7	25	9	25	4	26	10	26	0
26.	39	3	38	7	24	4	23	11	17	10	17	2	24	2	24	5	25	5	25	3	26	9	26	2
May 3.	38	8	38	9	24	3	24	1	18	3	17	5	23	11	24	11	25	4	25	2	27	9	26	6
10.	38	10	38	11	24	4	24	3	18	8	17	9	24	7	24	3	25	11	25	5	27	10	26	11
17.	38	2	38	10	24	2	24	3	18	11	18	1	25	9	24	7	27	2	25	10	28	10	27	5
24.	38	8	38	10	24	1	24	4	19	5	18	5	24	7	24	8	26	1	25	11	29	2	27	10
31.	39	3	38	9	24	0	24	3	20	0	18	10	26	9	24	11	27	5	26	3	29	7	28	4

FOREIGN MARKETS.—Per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1851.		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Feb. ..	Danzig	31 6 - 39 6	13 0 - 17 6	9 6 - 13 0	19 6 - 24 0	19 6 - 23 6	20 6 - 25 0
March	Danzig	32 6 - 39 6	13 6 - 18 0	10 0 - 13 6	20 6 - 26 0	20 6 - 24 6	21 6 - 26 0
April..	Danzig	34 6 - 42 0	14 0 - 19 0	10 6 - 14 9	20 6 - 27 6	21 6 - 26 0	22 0 - 26 6
May ..	Danzig	32 0 - 39 0	13 6 - 18 0	11 6 - 15 0	20 6 - 26 0	20 0 - 24 0	21 6 - 26 0
Feb. ..	Hamburg	30 0 - 36 3	18 0 - 24 0	11 9 - 13 6	19 6 - 26 0	24 6 - 30 0	20 0 - 26 6
March	Hamburg	32 0 - 39 0	16 6 - 20 6	10 6 - 13 0	18 6 - 25 0	23 6 - 27 6	20 6 - 25 6
April..	Hamburg	35 0 - 40 0	18 0 - 22 6	11 6 - 14 6	19 0 - 24 6	25 0 - 31 0	22 6 - 28 6
May ..	Hamburg	31 6 - 38 0	17 6 - 22 3	12 0 - 15 0	18 6 - 25 0	24 6 - 30 6	23 0 - 29 0
Feb. ..	Bremen	32 0 - 37 6	9 6 - 13 6	9 6 - 11 6	18 6 - 24 0	21 6 - 28 6	21 0 - 25 0
March	Bremen	33 6 - 38 6	10 0 - 14 6	10 0 - 12 6	18 6 - 24 6	22 0 - 29 6	22 0 - 26 6
April..	Bremen	35 0 - 40 6	12 6 - 16 6	10 0 - 13 6	19 6 - 26 0	23 6 - 30 6	22 6 - 28 0
May ..	Bremen	34 0 - 38 6	12 0 - 16 6	9 6 - 13 0	18 6 - 25 0	21 6 - 28 0	23 0 - 28 6
Feb. ..	Königsberg	31 6 - 38 6	18 6 - 23 0	9 6 - 13 6	16 6 - 22 6	19 6 - 24 6	21 0 - 25 0
March	Königsberg	32 6 - 39 0	17 0 - 22 6	10 0 - 14 0	17 6 - 23 0	18 6 - 24 0	21 6 - 26 0
April..	Königsberg	33 6 - 41 6	18 6 - 23 6	10 6 - 16 0	17 6 - 24 6	17 6 - 23 6	22 0 - 28 0
May ..	Königsberg	31 6 - 38 6	16 0 - 21 6	10 0 - 15 6	17 0 - 24 0	18 6 - 25 0	20 6 - 24 6

Freights from the Baltic to the East Coast 2s. 6d., to the West Coast 3s. 3d.; and from the Mediterranean, from 5s. 3d. to 8s.; and by steamer from Hamburg, 2s 0d to 2s 6d.

THE REVENUE.—From 5th April 1850 to 5th April 1851.

	Quarters ending April 5. 1850.	Quarters ending April 5. 1851.	Increase.	Decrease.	Years ending April 5. 1850.	Years ending April 5. 1851.	Increase.	Decrease.
	£	£	£	£	£	£	£	£
Customs....	4,432,584	4,548,266	115,682	..	18,538,263	18,730,562	195,299	..
Excise......	1,859,473	1,980,536	121,063	..	12,792,713	13,125,024	332,311	..
Stamps.....	1,538,125	1,548,008	9,883	..	6,354,429	6,105,524	..	248,905
Taxes......	177,231	167,784	..	9,447	4,332,979	4,350,731	17,752	..
Post-Office..	231,000	272,000	41,000	..	863,000	861,000	58,000	..
Miscellaneous	87,960	61,974	..	25,986	358,410	312,566	..	45,844
Property Tax	2,069,608	2,089,950	20,342	..	5,466,248	5,403,379	..	62,869
Total Income	10,395,981	10,665,519	307,970	35,433	48,656,042	48,888,784	613,362	357,618
	Deduct Decrease		35,433		Deduct Decrease		357,618	
	Increase on the qr. ..		272,537		Increase on the year ..		255,744	

TABLES OF BUTCHER-MEAT.—Per Stone of 14 Pounds.

Date.	London. Beef.	London. Mutton.	Liverpool. Beef.	Liverpool. Mutton.	Newcastle. Beef.	Newcastle. Mutton.	Edinburgh. Beef.	Edinburgh. Mutton.	Glasgow. Beef.	Glasgow. Mutton.
1851.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Feb. ..	5 0 - 6 6	5 9 - 7 9	4 6 - 6 0	5 0 - 6 6	4 6 - 5 6	6 6 - 7 6	5 0 - 6 3	5 3 - 6 6	5 6 - 6 9	5 6 - 7 3
March ..	5 6 - 6 9	6 3 - 8 0	5 0 - 6 6	6 6 - 8 0	4 6 - 5 9	6 6 - 7 6	5 3 - 6 3	5 6 - 6 6	5 6 - 6 9	5 6 - 7 6
April ..	5 6 - 7 0	6 3 - 7 9	5 0 - 6 6	6 6 - 7 6	5 0 - 6 0	6 0 - 7 6	5 6 - 6 6	5 9 - 6 9	5 9 - 7 0	5 9 - 7 9
May ..	5 6 - 7 0	6 3 - 7 6	5 0 - 6 3	6 6 - 7 6	5 0 - 6 0	5 9 - 7 3	5 9 - 6 9	6 0 - 7 6	6 0 - 7 6	6 3 - 7 9

PRICES OF ENGLISH AND SCOTCH WOOL.—Per Stone of 14 Pounds.

ENGLISH.	s. d. s. d.	SCOTCH.	s. d. s. d.
Merino, ...	13 0 to 17 6	Leicester Hogg, ...	11 0 to 16 0
.. in grease, ...	9 0 to 14 0	.. Ewe and Hogg, ...	9 0 to 13 6
South-Down, ...	13 0 to 17 0	Cheviot, white,..................	11 6 to 15 0
Half-Bred, ...	10 6 to 13 6	.. Laid, washed, ...	8 6 to 11 6
Leicester Hogg, ...	11 0 to 16 6	.. unwashed, ...	6 6 to 8 3
.. Ewe and Hogg, ...	9 0 to 14 0	Moor, white,.....................	6 3 to 8 3
Locks, ...	6 0 to 8 6	.. Laid, washed,..........	5 6 to 7 0
Moor, ...	5 0 to 7 0	.. unwashed, ...	5 0 to 6 3

CEYLON.

(*Concluded from page* 91.)

The cinnamon of Ceylon is universally allowed to be the best that is produced anywhere. Java, from whence we have the spice called cassia, has in vain attempted to rival Ceylon in the culture of this shrub, and the coarse plant grown at Malabar also cannot be at all compared to it. It was under the excellent Dutch governor, Falck, about the year 1770, that cinnamon was first cultivated in the island. It had, however, more than two centuries before, in its wild state, been turned to advantage by the Portuguese discoverer of the island, D'Almeyda, then governor of Goa, who agreed with the native sovereign for an annual tribute of 250,000 lb. of cinnamon, in return for the protection of the King of Portugal. Falck met with much opposition to his design from the natives, who declared that the quality of the spice would be deteriorated, and who carried their animosity so far as to destroy every laurel he had planted, by pouring boiling water over the roots. This conduct on the part of the native chiefs is scarcely to be wondered at, for they had derived large emoluments from the sale of the bark, the best quality of which was found in the forests and jungles of the Kandian provinces, into whose unwholesome recesses no European could penetrate. Governor Falck severely punished the offenders, and persevered in his design, which had also the additional benefit of improving the salubrity of Colombo, by the clearing away of the impervious underwood with which it was surrounded, and causing to arise in its stead a large extent of pleasing cinnamon gardens. The Dutch preserved the strictest monopoly in cinnamon, from which they derived an annual revenue of nearly £400,000; but when the island came into the possession of the British, the monopoly was granted to the East India Company for a sum far below its value, which indeed fluctuated to an incredible extent. At length in 1833, ten years after the right of cultivation had reverted to the Crown, the monopoly was abandoned, and the trade thrown open by the then Secretary of State for the Colonies, Lord Goderich. Cinnamon culture is now very much in the hands of private parties; but it is not profitable as an investment, only yielding a small annual profit after covering expenses. Some years ago, Government determined to sell off the whole of their cinnamon gardens, and did dispose of the greater part of them; but finding the prices to fall very low, they still retained a few, and these have lately been let at a very low rate for five years.

It has long been the fashion to assert that the scent of the aromatic spice can be felt even out at sea when vessels are passing the island. Accordingly, to flatter the delusion, some of the wags on board ship are in the habit of rubbing a little of the fragrant

oil on the sails. We have heard a story of one passenger having been so completely taken in by this trick, that he actually published an account of the cinnamon breeze, as it is called, "from his own experience of its fragrance many leagues at sea." In fact, it is only when the operation of peeling is going on, that a strong fragrance is diffused around; but even this scarcely penetrates beyond the spot where the peeler is performing his task. The cinnamon oil, which is extracted from the berry or fruit by bruising and boiling it—the making of which, however, is not a profitable employment—is used by the natives for medicinal purposes, and also for the anointing of their bodies. This oil, mixed, we believe, with cocoa-nut oil, was formerly used by the Kings of Kandy when giving audience; and when our troops took possession of the royal palace, there were found in it some enormously large wax-tapers, made also from a substance extracted from the berry. The best soil for cinnamon is a pure quartz sand, which is found as white and as fine as the finest table salt, even to the depth of a few inches; and it is curious to observe that the white ant, so destructive an insect in the island, does not at all injure the cinnamon gardens. It is, indeed, a proverb among the Cingalese, that four things are required for a thriving plantation—"plenty of sand, plenty of sun, plenty of white ants, and plenty of water." When a cinnamon bush is allowed to shoot up naturally for the sake of its seed, it will sometimes attain to the height of 30 or even 40 feet; but otherwise, by constant pruning, it is not allowed to grow higher than from 12 to 15 feet. The leaves, when they first spring, are extremely beautiful, being of a pale yellowish green, striped with scarlet; but when the laurel arrives at maturity, its foliage is of a dark shining green. The blossom is pure white and quite scentless, and the berry small, and in shape not unlike an acorn. The shrub has somewhat of the appearance of the Portugal laurel; indeed, a cinnamon garden is described as being not unlike a rich laurel copse.

After the parent tree has been cut down, it is from the shoots which spring up straight from the roots that the best cinnamon is obtained. It is of these shoots that the famous walking-sticks are made, which are so much esteemed by strangers visiting the island. The spice is the inner bark of the shrub when stripped of its outer cuticle, and is known to have attained maturity when it readily separates itself from the wood of the shoot under the knife of the peeler, who then cuts down the shoot, which is about half an inch thick when a year old; and having scraped off all the outer pellicles with a blunt knife, he removes the bark by making an incision the entire length of the shoot with a sharp-pointed knife. The smaller portions of the bark are then placed within the larger, and it is dried gradually, first in the shade, and then in the sun, when it curls and contracts into the pipe-like shape in which we see it. The regular seasons for barking cinnamon are

from April to August, and from November to January; but quantities are collected at other times besides these, as the shrub is seen to be ripe. There are said to be as many as nine different kinds of cinnamon; but of these there are only four recognised by the natives as genuine; and one of the four, the astringent cinnamon, is harsh, and in every way inferior. The other three are the honey, the snake, and the camphor cinnamon—the last so called from camphor being distilled from its roots. The best cinnamon is not thicker than strong writing-paper—pliable, light in the colour, and not unpleasantly pungent to the taste. It is the duty of the Government officers at Colombo to taste all the cinnamon before it is sent off; and some of the inferior kinds are so pungent and bitter that the mouths of the tasters are frequently excoriated in the process, causing them to eat bread and butter to alleviate the effects. The cinnamon is put up in bales of 100 lb. each, and the interstices are closely filled up with black pepper, which is considered to improve the flavour and value of both spices; and its price ranges from 2s. 6d. to 5s. 6d. per lb. The present consumption of cinnamon, of Ceylon growth, is about 3500 bales per annum, but only a very small portion of this is consumed in England; indeed, the highest quality is scarcely ever used here, being sent to France, Spain, and South America. Besides the cinnamon gardens around Colombo, there are others to be seen at Galle and Madera. The wood is used as fuel; indeed, there is no part of the shrub that is not turned to account. Till the year 1847 a high duty was paid on the export of cinnamon from Ceylon. At one time it was 3s. a pound, which was successively reduced to 2s. and 1s., which latter was the rate in 1847, when a general revision of the export duties took place, and the duty on cinnamon was reduced to 4d. a pound. The high duty, it was found, was ruining the trade, particularly in the lower qualities of cinnamon, as these were subjected to a most unequal competition with the produce of Java, where no such duty was paid. To remedy this, the low duty now payable was wisely adopted, and the Ceylon cinnamon-grower has now a fair prospect of success. Besides the above duty, there is another of 3d. a pound payable in this country.

Some years ago great expectations were formed of the success of *sugar-culture* in the island, the quality of which was pronounced to be equal to any produced in Siam or China. It is now about twelve years since Mr Charles Edward Layard and Mr James Anthony Moyart, both of whom were possessed of unwearied activity and thirst for enterprise, introduced the culture of the sugar-cane on their estates at Kaltura. The experiment proved unsuccessful, partly because the trial was made on too extensive a scale for a first attempt, and also on account of the iron, which was almost everywhere found to be mixed with the soil. Some time afterwards, Mr Hudson formed an estate at Peradenia, near Kandy, and with much better success, which induced many planters to follow his example. The greater number, however, of

the estates planted with sugar-cane have now been abandoned, after a dead loss, as they did not pay even the expense of working. Among the few still carried on, and said to pay, is Peradenia, which can scarcely fail to do so, as they sell all their sugar for the supply of Kandy, and that almost at a retail price. The other estates are at Negombo and Galle. We sometimes now hear of sugar estates being sold for anything they will bring, but never of a new one being formed. Experience has proved that, although the quality of the sugar grown in Ceylon is unexceptionable, being quite as fine, and bringing as high a price as the West Indian, the quantity is not found to be at all equivalent. This, together with the greater expense of culture as compared with that of slave labour, must account for the general want of success that has hitherto attended the cultivation of sugar.

The *indigo* plant is indigenous to the soil of Ceylon, and grows luxuriantly at Jaffna and in the Wanny district; also at Tangalle, in the southern province, which is indeed the best adapted to the culture and manufacture of indigo, from abundance of the wild plant being found there, also every facility for transport by water to the different ports of export, and every material for building an indigo factory being close at hand. It is not easy to account for the apathy that has prevailed as to the culture of indigo, nor very creditable to British enterprise that the last export of the dye was under the Dutch, in the year 1794. Mr Fawkener, an extensive indigo-planter in Bengal, made a proposal to Governor Sir Robert Brownrigg, in 1817, for raising indigo on a great scale in the island; but the governor was then so entirely occupied in suppressing the Kandian rebellion that the proposal, for the fulfilment of which ample securities were offered, did not meet with the attention it merited. Some years after, a Swedish gentleman, of the name of Tranchell, but without capital, proposed the formation of a joint-stock company, for the culture of indigo in Tangale; but although Sir Edward Barnes consented to become its patron, many difficulties, and a tedious correspondence with the agricultural society of Ceylon ensued, which was protracted, till the death of Mr Tranchell, in 1828, finally put an end to the scheme. The cultivation of the plant is now being tried on a small scale at Jaffna, by Mr Lemarchand, formerly an indigo-planter in Bengal. A portion of it has been prepared, and the quality found to be excellent. The climate is peculiarly favourable, and labour cheap, so that we cannot but conclude that there is now a fair prospect of success.

Tobacco is grown at Jaffna and Baticaloa to a considerable extent, but only by the natives, in small patches round their houses. It requires such constant care to prevent the leaf being devoured by caterpillars that no European can cultivate it. A native looks over his little bed morning and evening, and kills the insects. The cultivation of it was tried also at Galle, but failed. Jaffna cheroots have been vaunted, by some who consider them-

selves connoisseurs in tobacco, as quite superior to anything that Havannah can produce; but a Jaffna cheroot can no more be compared to a genuine Havannah than one of Barclay's dray-horses to the "Flying Dutchman." The natives of Malabar, however, give to the Jaffna tobacco the preference greatly over their own. Accordingly, about the beginning of the present century, the Rajah of Travancore, who maintained, and still maintains, a strict monopoly in this article in his own dominions, entered into a contract with the government of Ceylon for all tobacco grown in the province, by which the latter averaged an annual profit of not less than £10,000; but this arrangement was the cause of serious loss to the tobacco-growers of Jaffna, by the increased consumption it occasioned of inferior kinds. Recourse was had to various plans, with the view of remedying this evil, and of encouraging the growth of the plant in Jaffna; but none of them were distinguished for financial knowledge, and the trade rapidly declined even in those markets where the Jaffna tobacco had long been highly prized. At length the government of Ceylon, in the year 1837, determined on substituting the small duty of 2½ per cent for the enormous one of 200 per cent, which had crippled the trade since 1824, after which an immediate start, and an immense and steady increase, took place. We find that, in the years 1844 and 1845, tobacco was exported from the island to the value of more than £17,000; but the export tables show a considerable decrease since that period. The present Rajah of Travancore keeps an agent constantly at Jaffna, who purchases a large proportion of the produce, and ships it to the coast.

The *nutmeg* tree grows and bears, and two or three small plantations have been made; but it is not likely to become a favourite investment, as the tree takes nearly twenty years to come into bearing.

The cultivation of *cotton* has been tried both at Jaffna and at Baticaloa, but only with very partial success. Many writers on Ceylon have urged this subject on the attention of Government; and Sirr, in his late work, quotes the opinion of an American planter, that Ceylon is capable of producing cotton "equal in quality" to the American, and at a cheaper rate, as the cost of labour there is greater than in Ceylon. We cannot but think, however, that the planter alluded to cannot have remained long enough in the island to judge of the fitness of the climate, soil, and temperature, on all of which he so hastily pronounces a favourable verdict, whereas that of "not proven" would have been a more just one; for the truth is that the crop frequently proves a failure, owing to the rain commencing before the cotton can be picked; and if it gets wet when nearly ripe, the quality is deteriorated. When it can be secured in good order, it is doubtless of superior quality, and brings a high price in the home market.

With the view of cultivating the growth of *silk* in Ceylon, Mr Bennet, thirty years ago, introduced the white and digitated mul-

berry plants, and distributed cuttings of them to all the leading people in the island. The mulberry tree grows abundantly, and with a rapidity so great that in little more than six months a plantation is generally found to be in full bearing. The most extensive silk-growers in the world, the curious and ingenious Chinese, have proved that the tree which bears the least fruit and the most foliage is the best food for the silk-worm. After many expedients for increasing the quantity of foliage, they found that by feeding hens on the ripe fruit of the mulberry tree, after it had been allowed for some time to dry in the sun, and then planting the undigested seeds which came from their stomachs, after those seeds had been well soaked in water, the trees thus produced had greatly more foliage than fruit. The eggs of the silk-worm requiring constant washings, the Chinese always select their ground for them on slopes close by pure running water. It is also a curious fact in the natural history of silk-worms that they are extremely sensitive, not only to smells, but to noise; and that, when fully hatched, the barking of a dog or the crowing of a cock throws them into disorder. Mr Bennet made other suggestions, such as sowing indigo for an under crop, and planting rows of plantain trees to form a shade for the young mulberry plants; but we can hear of no trial of any consequence having been made, until of late years near Kandy—and even that on no great scale, though quite successful. It is now understood that Baron Delmar, a Frenchman, who has extensive coffee estates in the island, is going to try the growth of silk on a large scale.

The magnificent *cocoa-nut* palm-tree abounds in Ceylon, encircling the greater part of the island, thriving always best the nearer it is planted to the sea, and the more sandy the soil. It grows to the height of 60, 80, and sometimes 100 feet; and from the top of its tapering stem radiates a lovely and verdant circle of feathery foliage. We shall not attempt to detail the many uses of this tree, so eloquently descanted on by Eastern poets; only remarking, that, besides the uses of the nut itself, a juice called toddy, which is the sap of the cocoa-nut tree, exudes from it, just below the point from which all the leaves radiate. First, a swelling is perceptible, which gradually increases and then bursts. The fruit is then seen just forming, something like a head of corn: these increase in size, and in a short time each grain-like portion of the head assumes the size of a walnut, and eventually attains the full dimensions of the cocoa-nut; but if you wish toddy from the tree, you can have no fruit that same season. The swollen part we have mentioned, from which the fruit bursts forth, is at an early stage punctured, and the sap, which would have gone to form the fruit, flows from this puncture, which is kept open with a piece of the cocoa husk. Clay pots, called *chattys*, are hung up, into which the toddy trickles down; and these are emptied every morning. When fresh from the tree, it is a cool and pleasant morning draught. From this toddy a

coarse brown sugar is prepared, called jaggery, and excellent vinegar. There is also distilled from it the finest possible arrack. This magnificent tree, when planted near the sea, blossoms in the fifth year; but in high and inland situations, not till the sixth or seventh. It continues to bear fruit for upwards of sixty years. It cannot be denied, however, that the profits arising from cocoa-nut planting have disappointed many. The estates look most beautiful; but the question is, how will the trees bear? The beetle has, we understand, done more damage than planters generally are willing to admit. It bores into the soft heart of the tree at the top of the stem, just where the leaves spring from; and, without any visible sign, down tumbles the whole top of the tree some morning! After this the tree always dies; and as the most common time for this unpleasant accident is when the tree first flowers, there are five, six, or seven years' labour lost. The calculations of the profits from making sugar from the cocoa-nut are extravagant, and it is not unlikely that tapping young trees will kill them—at all events, prevent their producing many or good nuts. Baticaloa seems, both in climate and soil, a better locality than Jaffna for this cultivation. The facilities for shipment are the same, but labour is a little dearer.

The Palmyra palm grows in immense quantities in Jaffna. In appearance it a good deal resembles the cocoa-nut tree; but, unlike it, takes nearly twenty-five years to come into bearing. The fruit, which grows in clusters like the cocoa-nut, becomes, after being dried in the sun, the food of the natives, almost in the same proportion as rice. The wood makes good rafters, and has been largely exported to Madras during the last few years. The liquid called toddy is also extracted from this tree in great quantities, and converted into jaggery, which is sent over to the coast to be refined into sugar. It has often been proposed to erect a refinery in Jaffna, which certainly would be a good speculation, as the article pays at present, even after the extra expense of shipment to the coast.

It would be quite in vain to attempt, in a space like ours, to give the reader anything like an account of all the vegetable wonders of Ceylon, we have therefore confined ourselves hitherto to those most interesting to agriculturists. But we cannot quit the subject without some mention of the talipat palm, the most beautiful and magnificent of all the palms of the island. The trunk near the ground is generally about 9 feet in circumference, and it grows to the height of from 70 to 100 feet, tapering towards the summit, from whence its immense leaves spring and droop all around. It is a common belief among the natives that this tree lives a century before it blossoms, after which it immediately begins to decay. The flower, which is large, its full height being nearly 30 feet, and of a beautiful shade of yellow, remains some months in bloom, and its bursting forth from the spathe is said to be attended with a loud report. The

leaf of this splendid tree is circular at the point, has a feathery handle, and folds up like a fan. It is the largest leaf known, its circumference ranging from 30 to 40 feet; its extreme length from the tip to the end of the stalk sometimes measuring 25 feet, and its width varying from 12 to 17 feet. From the circumstance of its being impervious to rain, and combining also, with this quality, extreme lightness, it has become invaluable to the Eastern traveller, and is used for tents, the leaf being supported by bamboo canes. These tents, indeed, are frequently called talipats; for we find in journals of expeditions to Adam's Peak and elsewhere, "here we pitched our talipats." The natives subdivide the leaf into eight parts, draw out the fibres, and then stitch the different parts together, according to the uses to which it is to be applied. It was the privilege of the native kings, and of those also belonging to the highest caste, to have these leaves borne over and before them, the number accorded to each being fixed with reference to rank and dignity. They also use them as fans and umbrellas, and as a thatching for their bungalows, which answers the purpose excellently. The Cingalese records are written on strips of this leaf; and some of these, which are still extant, have retained all their original freshness throughout a period of many centuries: they are engraved with an iron style. From the pith which is found in the trunk of the talipat palm, there comes, when dried, a fine meal, which the natives make into cakes. From this granulated pith, sago has been prepared, but it is generally considered to be of inferior quality.

It would be quite out of our province to give here an account of the wild animals, the numerous and beautiful fish tribe, and the other peculiarities of the island; we shall only make a few remarks on the breeding and importing of stock, in addition to what we said in a former number. The only live stock belonging to the island are cattle, the horses being all imported. Government tried breeding horses at Delft, near Jaffna, but gave it up. There are sheep at Jaffna, but nowhere else, as they cannot stand the moist climate of the hills. Cingalese cattle are not large, but they are well shaped and hardy. The cows give very little milk, few giving so much as two quarts a-day, but it is rich. To make 1 lb. of butter, it takes 12 quarts of the milk of a Cingalese cow, and 16 quarts of a coast cow. A friend bought eight Cingalese cows, three of which had recently calved, and the others were all in calf, in one lot. They cost him, delivered at his property, £13, 5s.; but he has been very unfortunate with them, for they all got sick from the change of grass and water; and although none of the cows died, two of the calves did, and one cow calved prematurely; and although both mother and child were "doing as well as could be expected" the last time we heard of them, still they were very poor, and the cow giving no milk. Cows are very cheap on the coast, (from 10s. a-head upwards,) but it is difficult to get good ones brought to the interior. No native can be trusted, and it

will not pay to go over and buy them. If you sent a man, you would probably get a very fair lot of cattle in appearance, but find half of them barren, or so old that they would perhaps only calve once more. They bring a few over for sale, but they are always wretched brutes. Even when you get pretty good coast cattle, you must calculate on almost a fourth of them dying from the climate. There has been this year a severe murrain among the cattle, chiefly the Bandy bullocks. Suppose you pay £2 for a cow, and she gives you two quarts of milk a-day for six months, this is equal to about 12 lb. of butter, which, at 3s. a lb., about clears off the purchase-money, and leaves you the cow and calf for nothing; so there is a good margin for contingencies, and every reason to think that fattening cattle and making butter would prove profitable. The expense of feeding is not great. Pasture, as may be supposed, is very rich. As an instance of the luxuriance of tropical vegetation, we may mention that there is a grass in Ceylon, called mana grass, many of the seed stalks of which grow to the height of 12 feet, its quite ordinary height being 6 feet and upwards. This grass forms an excellent thatch.

By an almanac lately published in Ceylon for the year 1851, we find an account of the total area under cultivation, and of the distribution of the different crops, which, although considered to be but an approximation, is still valuable as such. In the central province alone, we find that upwards of 1800 acres, formerly planted with coffee, have been abandoned. There are no returns from the other provinces, so that we cannot give the total abandoned. To balance this, however, we understand from private parties that there are now about 3000 acres of new land being brought under cultivation. The author seems more uncertain as to the space occupied by cinnamon gardens than by all the other kinds of produce, merely guessing it at 13,000 acres, not having been able to ascertain the amount in the southern province. The result, then, stands as follows:—

	Acres.
Cocoa-nut cultivation,	122,000
Coffee,	80,000
Cinnamon,	13,000
Sugar,	2,500
Palmyras at Jaffna,	35,000
Rice,	400,000
Fine grain,	100,000
Tobacco,	10,000
Pepper, Indian-corn, ginger, cotton, &c.,	10,000
Pasture,	400,000
Total,	1,172,500

We repeat that these are only given as approximations. The total area of Ceylon is 15,808,000 acres, of which about 1,000,000, or little more than one-fifteenth, seems to be cultivated or used as pasturage.

If in what we have said of the present state and prospects of

Ceylon we may have brought down the high ideal that many have formed of this "gem of the Eastern wave," this "pendant jewel of India," or offended others who, having interests greater or lesser there, are still deluding themselves with visions of high prices and splendid fortunes, our only apology is that it is all true. The discrepancy between the glowing descriptions of foreign countries given in books, and the accounts we hear from prudent and disinterested persons who have visited or resided in these, is quite distressing. The evil done is incalculable, and in no country has it been greater than in Ceylon. Besides the losses, and, to many proprietors, the ruin that ensued a few years ago, owing to the fall in prices and other reverses, many young men also suffered severely. Even after there had been ample time for warning, they were still lured away by the bright prospects held out to them. On their arrival in the island, they found no situations were to be had such as they had expected. Hundreds of them, if they had not means to leave the island, either accepted of situations far beneath them, or drank themselves to death in despair. These are most unpleasant truths, but they must be told. We look to the rapid means of communication between our own and foreign countries for the cure of these evils; for we fear that, with all our knowledge, the spirit of adventure and speculation is as rife as ever. It was distance that made foreign countries wonders and mysteries to us, for the many had nothing for it but to believe the few; and fortunes were made with such unheard-of rapidity that the wise shook their heads, and the vulgar were struck with superstitious awe. Now, however, that, instead of twelve months, and often more, elapsing before we could have question and answer from over "the black water," as the Indians call the ocean, we can have it in sometimes less than three, we are no longer likely to be long deluded by false representations—nor, indeed, can we have any excuse for remaining ignorant of what every one may learn by a very ordinary amount of inquiry.

THE FARMERS' NOTE-BOOK.—No. XXXIII.

Effects of Burnt Clay as a Manure. By Dr VOELCKER, Professor of Chemistry in the Royal Agricultural College, Cirencester.—(*Concluded from p.* 79.)—In burning clay properly, I have found that a much larger amount of *potash* is rendered soluble, in a way which I shall explain, after having given the details of my analyses. But every physiologist knows that potash is one of the most valuable and essential food of plants. I am inclined, therefore, to consider the fact, that potash being rendered more soluble on burning clay, is the chief cause of the beneficial effects of burnt clay.

I am indebted to Sir Thomas Tancred for the material with which my experiments were made.

Having procured for me some clay of the new red sandstone formation from the farm of Huntstile, near Bridgewater, tenanted by Mr Thomas Danger, I proposed to myself the following questions:—

1. Is this clay more soluble after burning than in its natural state?

2. What are the relative proportions of insoluble and soluble matters in this clay, when burnt in different manners?

3. What is the relative composition of the soluble portion in each case?

4. Is it essential or desirable that clays fit for burning should contain lime?

5. What are the characteristics of clays, of which it can be said that they are totally unfit for burning?

6. Can it be determined by chemical analysis whether burning will be efficacious in rendering clay a fertiliser?

7. What are the reasons of the failure attending over-burning?

8. Does moderately burnt clay absorb more ammonia from the atmosphere than unburnt clay?

9. Does over-burnt clay absorb any or no ammonia from the atmosphere?

10. Is ammonia found in burnt clay, containing protoxide of iron, when exposed in a moist state to the atmosphere in much larger quantities than in the same clay exposed in a dry state to the atmosphere?

11. What is the reason that burnt clays improve, especially root and other green crops, as Mr Woodward states?

The nature of the *chemical* changes, which may be supposed to affect the action of burnt clay on the land to which it is applied, was examined by four distinct analyses.

No. I. Clay-soil in its natural state.

No. II. A quantity of the same clay-soil was exposed to a *dull* red heat in a *closed* platinum crucible, and kept at that temperature for half an hour. The clay, after burning, had a *dark-grey* colour.

No. III. Another portion of the same clay-soil was exposed to a *red* heat for half an hour in an open crucible. The contents of the crucible were frequently stirred with a platinum wire, in order to effect the complete combustion of all organic matters, and to secure the perfect oxydation of any protoxide of iron which was present in the clay. After burning, the colour of this portion of the clay was red; rather brighter than the natural colour of the soil.

No. IV. A fourth portion of the same clay-soil was exposed for about three hours to a full red heat in an open crucible.

Though water, containing carbonic acid, acts more slowly, yet it produces the same effects on the constituents of clay as dilute mineral acids. I preferred to apply dilute muriatic acid instead

of water charged with carbonic acid, in order to test the solubility of the above four samples of clay. Accordingly, separate quantities of Nos. I., II., III., and IV., were taken for analysis, and each boiled for half an hour in four ounees of water, containing one-tenth of its bulk of hydrochloric acid; the insoluble part of the clay was collected on a filter, and washed with distilled water until nothing more was dissolved.

In the soluble part of Nos. I., II., III., and IV., the following substances were determined quantitatively:—Soluble silica, oxide of iron, and alumina; carbonate of lime, potash, soda, and phosphoric acid.

In No. IV. phosphoric acid was not determined.

The following table exhibits the results of these several analyses:—

	No. I.	No. II.	No. III.	No. IV.
Water, driven off at 212° F.,	5.539	9.160	9.200	9.300
Organic matter, and water of combination,	3.621			
Insoluble matter, (in dilute hydrochloric acid,)	84.100	80.260	81.845	85.309
Soluble matter, consisting of—				
Soluble silica,	1.450	1.380	1.580	1.150
Oxides of iron and alumina,	3.070	8.245	6.092	2.970
Carbonate of lime,	.740	.420	.550	.188
Potash,	.269	.941	.512	.544
Soda,	.220	.336	.314	.104
Phosphoric acid,	.380	.165	.128	Not determined
Chlorine and sulphuric acid,	traces	traces	traces	traces
Magnesia, (not determined,)	...	...	...	...
	99.389	100.907	100.221	99.565

The suggestions to which these analytical results give rise will be more intelligible after we shall have briefly considered the origin and composition of agricultural clays in general, and pointed out on what substances chiefly the fertilising powers of clay depend.

Clays generally result from the disintegration and degradation of granitic and felspatic rocks. Felspar, a mineral composed of silicate of potash or soda, and silicate of alumina, exposed for a long time to the united action of the atmosphere and water, suffers a gradual decomposition, and falls altogether to powder. Silicate of potash, a soluble salt, is washed out by the rain falling on the decomposed rock, and converted, in its turn, by the carbonic acid of the atmosphere into carbonate of potash and silica. Part of the silica remains behind with the insoluble silicate of alumina, the chief constituent of clays. Agricultural clays, however, are never pure silicate of alumina, but mixtures of pure clay (silicate of alumina) with more or less of sand, undecomposed fragments of felspar and other minerals, lime, magnesia, free alumina, oxide of iron,

soluble silicate of potash and soda, and traces of phosphoric acid, chlorine, and sulphuric acid. The state of combination in which these different constituents occur, varies in different clays. The complex nature of agricultural clays will become apparent by the subjoined analyses of three samples of clays from Dumbelton, in Gloucestershire, made in my laboratory.

	No. 1.	No. 2.	No. 3.
Water of combination and organic matter, .	7.69	6.62	6.68
Oxides of iron, ...	8.24	7.33	8.63
Alumina, soluble in acids, ...	8.04	10.62	9.25
Alumina, in a state of silicate, ...	10.04	7.06	9.66
Lime, carbonate of, ...	1.12	0.70	0.19
Lime, in a state of insoluble silicate, . .	0.44	0.54	0.24
Magnesia, soluble in acids, . . .	0.62	0.12	0.56
Magnesia, in a state of insoluble silicate, . .	0.34	0.39	0.34
Potash and soda, soluble in acids, . . .	0.73	1.04	1.13
Potash and soda, in a state of insoluble silicate, .	0.94	2.70	1.82
Silica, (soluble in acids,)	0.09	0.06	0.08
Silica, (insoluble in acids,) . . .	61.71	62.82	61.42
	100.00	100.00	100.00

As alumina or silicate of alumina is not found in the ashes of cultivated plants, the chief component part of clay cannot be said to contribute in itself to the direct nutrition of plants, and we have, therefore, to look amongst the accessary ingredients of clay for the fertilising agents or substances which are used as direct articles of food by plants. Lime, magnesia, sulphuric and phosphoric acid, and chlorine—substances which, in larger or smaller quantities, occur in clays—are, indeed, essential to the growth of plants; but the value of an agricultural clay chiefly depends on the proportion of potash and soda which it contains. Potash is an essential element in all ashes of plants, and acts as a most powerful manure. The high price of salts of potash unfortunately prevents their more extensive application in agriculture, and plants are, therefore, dependent in a great measure on the natural sources from which they derive their potash. The chief source of potash in ordinary soils is the clay, which forms part of almost all soils, and which itself usually contains some undecomposed silicate of potash or a duple silicate of potash or soda and an earthy base, from which, in gradual decomposition, potash is set free and made available to plants. Clay, we have seen, is in many cases derived from felspar: the more undecomposed felspar-fragments a clay contains, the more it is likely to prove useful to plants. Hence we are enabled to explain the advantages of fallowing. By that process a fresh portion of the soil, not hitherto exposed to the action of the atmosphere, is brought up, and the undecomposed fragments of felspar are forced by the combined action of air and

water to yield their potash and soda, which are the indispensable requisites of a healthy vegetation.

Without doubt, then, potash is the most valuable substance in clays, and, if I am not mistaken, the substance on which their manuring qualities mainly depends.

In an age of railway and steam-boat enterprise and telegraphic despatch, agriculture is forced to progress, and, in consequence of this, fallowing must necessarily yield to some more extensive and expeditious means of gaining the same advantages. Now, I am prepared to show, that, in burning clay, precisely the same changes are effected in a few days which in bare-fallowing are produced in so many months: in other words, the natural fertility of the soil, which in fallowing is restored after a long interval of rest, can be restored in many instances in a few days, by burning land.

Let us, however, examine the proposed questions separately.

1. Is the clay from Huntstile, near Bridgewater, more soluble in dilute hydrochloric acid, after than before burning?

A reference to the above tabulated analytical results will show that, after burning, this clay has become much more soluble than the clay in its natural state.

2. What are the relative proportions of soluble and insoluble matters in this clay when burnt in different manners?

The above-mentioned results not only teach, generally, that clay becomes more soluble in burning, but that the temperature to which it is exposed mainly regulates the solubility of the clay. A proper temperature for burning clay is, indeed, a condition in the process, on which the success of the operation chiefly depends.

We see, from the preceding tabulated results, that clay, in 100 parts in its natural state, furnishes only 6.74 grs. of soluble inorganic matter, leaving 84.100 insoluble mineral matters behind; whilst the same clay, burnt at a temperature, and under circumstances under which the organic matter was not altogether destroyed, left 80.260 grs. of insoluble inorganic substances, and furnished 10.580 grs. of soluble inorganic matters. An increase of the temperature, sufficiently high to burn off the small amount of organic matter which enters into the composition of this clay, had the effect of producing the solubility of its constituents to about 1½ per cent; and a more protracted exposure to a still higher temperature had the effect of a further reduction of its solubility, to such an extent that this over-burnt clay became less soluble than the same clay in its natural state.

	Proportion of Soluble inorganic matter.	Proportion of Insoluble mineral matter.
Clay, No. 1, (unburnt,)	6.740	84.100
Clay, No. 2, (slightly burnt,) . .	10.580	80.260
Clay, No. 3, (burnt stronger than 2,) .	8.955	81.845
Clay, No. 4, (over-burnt,) . . .	5.391	85.309

It is difficult to determine at what exact temperature clay should be burnt for agricultural purposes, and I am inclined to believe that this point cannot be settled by small experiments in the laboratory. Besides, if it could be done, the mere indication of the degree of heat would not be a sufficient guide to the practical man, and therefore possesses little more than a theoretical value. Valuable results, however, might be obtained by recording the exact circumstances under which different clays have been burnt, by observing the practical effects of clay burnt in different ways, and reserving a portion of each sample of clay for chemical analysis. The analysis of a series of different clays, and clays burnt in different manners, I have no doubt, besides throwing additional light on the rationale of the process of soil burning, is likely to be attended with important practical results.

3. What is the relative composition of the soluble matter in clay burnt in different manners?

Referring to the above analytical results, we find much difference in the composition of the soluble portion of each of the four samples of clay; but I would invite particular attention to the important fact, which is distinctly proved by these analyses, that the proportion of alkalies, more particularly that of potash, is much larger in the burnt than in the unburnt clay. Finding the quantity of so valuable a fertilising substance as potash very much increased in the soluble portion of burnt clay, and considering that this is precisely the effect produced in fallowing, as demonstrated above, I have no hesitation to assign the chief cause of the beneficial effects of burnt clay to a larger quantity of potash which is liberated by burning and rendered available for immediate use by plants.

The temperature to which the clay has been exposed, here regulates the proportion of potash rendered soluble in dilute muriatic acid in a remarkable manner. In the natural clay only 0.269 of a per cent of potash were soluble; whereas in clay burnt at a moderate heat, and under circumstances resembling those under which clay is burnt in the field, the quantity of soluble potash amounted to more than three times the former quantity, the exact proportion of potash being 0.941 of a per cent. In clay No. 3, the higher temperature to which it was exposed caused a diminution of the last-mentioned proportion of potash, the actual number obtained, on analysis of No. 3, being 0.512 of potash, and in No. 4 nearly the same quantity of potash—namely, .544 grs. were obtained.

The actual quantities of soda rendered more soluble in burning are trifling, but still sufficiently large to confirm the fact that soda is rendered more soluble in burning. The higher temperature applied in burning No. 3 and No. 4 likewise was attended with a slight diminution of soluble soda, when compared with No. 2.

	No. 1.	No. 2.	No. 3.	No. 4.
Soda, . .	0.220	0.336	0.314	0.104

Another important difference in the composition of these four samples of clays—which, however, is more interesting in a theoretical than in a practical point of view—is presented in the relative quantities of lime which were found in the soluble portion of each. In clay in its natural state, the quantity of carbonate of lime amounted to 0.740 per cent; in moderately burnt clay (No. 2) to 0.420; in clay burnt at a higher temperature (No. 3) to 0.550; and in over-burnt clay (No. 4) to 0.188. The three latter quantities are marked down in the analyses as carbonate of lime, for the sake of comparison with No. 1, in which the lime really existed as carbonate of lime; but as not the slightest effervescence took place on dissolving the burnt clay in dilute muriatic acid, it is clear that the lime did not exist in it in a state of carbonate. The lime must have existed in No. 2, No. 3, and No. 4, as caustic lime, or in a state of silicate; it would have been, therefore, more correct to indicate the quantity of pure lime in the above table.

The excess in analyses No. 1, No. 2, and No. 3, is partly due to this inaccuracy of stating the results, partly to the fact that silicate of protoxide of iron, in burning, becomes decomposed. The protoxide of iron is rendered soluble in dilute muriatic acid, but in the analyses it is determined and calculated as peroxide of iron; hence we find the largest excess in No. 2, in which most iron has become soluble in dilute muriatic acid.

The following considerations induce me to think that the lime in Nos. 1, 2, 3, and 4 existed in a state of silicate. Chemists are well acquainted with the methods of determining the quantity of potash and soda in insoluble silicates, to which class of silicates felspar belongs.

The usual method consists in fusing the finely powdered substance with an excess of carbonate of baryta. In this process potash and soda are rendered soluble in the following manner:—The baryta combines with the silica, orginally present in combination with potash and soda: silicate of baryta is formed, and the alkalies, potash and soda, uniting with the carbonic acid of the carbonate of baryta, are rendered soluble.

Lime, which in its chemical relation is closely allied to baryta, acts precisely in the same manner on insoluble silicates of potash and soda. Now, if clay originally contains carbonate of lime, it will act at an elevated temperature on the insoluble silicate of potash, which is present in many clays in the shape of fragments of felspar; and by duple decomposition it will give rise to the production of silicate of lime and carbonate of potash. Silica enters into combination with lime in different proportions: some of these combinations are soluble in dilute acids; most of them are insoluble. Instead of carbonate of lime and insoluble silicate of

potash, we thus find in burnt clay a larger proportion of soluble potash and silicate of lime, which is partly insoluble in acid. The diminution of the quantity of lime, and the increase of potash in the soluble portion of burnt clay, thus find a ready explanation. Much, however, as indicated by the practical observations, and the above analytical results, depends on a proper temperature. If the heat is allowed to become too intense, new changes in the constituents of clay are produced, which have the effect of rendering the potash again less soluble.

The fact that felspar is more readily decomposed after having been moderately calcined is not a new one, Professor Fuchs of Munich having shown clearly that this is the case, not only with felspar, but also with other minerals, into the composition of which silicate of potash enters. Fully in accordance with this fact is the practical observation of Professor Lampadius, who found, by a series of field experiments, that moderately calcined gneiss, granite, certain kinds of porphyry and trap rocks, all of which contain silicate of potash, in a similar manner as burnt clay, promote the luxuriant growth of many plants in a remarkable manner. It would be doing injustice to Professor Zierl of Munich to leave unnoticed that, in speaking of the causes of the effects of burnt clay, he suggested whether the accessary constituents of clay, particularly the alkalies, might not be rendered more soluble in the process of burning. Had Professor Zierl submitted unburnt and burnt clay to chemical analysis, he would, no doubt, have found that this was really the case; but as he brought forward no experimental proof in support of his theory, it had the fate of being disregarded by many at the time of its publication, and of being soon after forgotten by most.

As far as I am aware, the above analytical results, in support of my theory respecting the liberation of potash in clay, are the first direct proofs which have been furnished by any chemist. Though unacquainted with Professor Zierl's theory, and Professor Fuchs' experiments, when I undertook the investigation, I am bound to acknowledge that the theory I have embraced, respecting the liberation of potash in clay, is not a new one. Disclaiming the merit of being its discoverer, I shall feel amply rewarded by seeing these direct experimental proofs in support of this theory confirmed by the experience of other chemists.

4. Is it essential, or desirable, that clays fit for burning should contain lime?

My own experiments have been confined to clay which contained originally lime; I am, therefore, not prepared to answer the first part of the question—namely, is it essential that clays fit for burning should contain lime? The observations already made respecting the action of lime on insoluble silicates of potash and soda, however, enable me to answer the second part of

the question—namely, is it desirable that such clays should contain lime?—in the affirmative. If the above explanation of the action of lime on silicate of potash is true, we can easily conceive how the addition of lime to clay, originally poor in this element, will increase the amount of soluble potash and soda. In this view of the matter I am much confirmed by an observation of Professor Fuchs of Munich, to which particular interest attaches. This eminent man, distinguished both as a good chemist and mineralogist, found that when felspar is moderately calcined, and in a powdered state is boiled with quick-lime and water for a short time—or even digested in the cold with quick-lime and water for a longer period—so large a proportion of potash is liberated from the constituents of felspar that, on these grounds, he recommended a process of extracting and manufacturing potash on a large scale from felspar. Professor Fuchs has shown that, under these circumstances, insoluble silicate of lime and soluble carbonate of potash are formed. I would, therefore, suggest the application of quick-lime to newly burnt clay land, or the mixing of clay with lime before burning, as likely to be attended with most beneficial effects.

5. What are the characteristics of clays, of which it can be said that they are totally unfit for burning?

The chief mass of all clays, silicate of alumina, does not in itself serve as direct food to plants. Pure clays, such as pipe and porcelain clay, which almost entirely consist of silica and alumina, for this reason will be found as sterile after burning as they are in their natural state. We have seen that the accessary constituents of agricultural clays furnish the materials from which plants derive inorganic food. Of these the most important and valuable are phosphoric acid and the alkalies. As phosphoric acid is not rendered more soluble in burning clay, but rather the contrary, as shown by the above table, we are bound to look to the alkalies as the chief fertilising substances in clays. The analyses of three different kinds of clays, from Gloucestershire, given above, as well as a great many others published by Professor Johnston, exhibit a great difference in the relative proportion of potash and soda which they contain. Whilst some of them contain considerable quantities of potash and soda, others contain but mere traces. Now, if it be true what has been advanced with regard to the fertilising substances in clays, and the effects produced in burning, we cannot hesitate to pronounce all clays which contain no potash or soda in an undecomposed form, or mere traces, as entirely unfit for burning. Experience, I think, will prove that such clays, naturally unfertile, will not be improved in the least by burning. On the other hand, those clays which contain undecomposed insoluble silicate of potash and soda, in the shape of fragments of felspar or any other mineral, will be found the more useful after burning, I think, the more of these alkalined silicates they originally contain.

6. Can it be determined by chemical analysis whether a clay will be efficacious when burnt or not?

From the preceding remarks it follows that the fertilising effects of clay mainly depend on the proportion of alkalies which it contains; and as any good analytical chemist may determine the exact quantity of potash and soda which may be extracted from a clay, we possess the means of deciding at once whether a clay is likely to be efficacious when burnt or not. The advantages which result from a previous analytical examination become most conspicuous when we consider that the trifling expense for analysis will guard the farmers against failure and loss attending the investment of much money and labour in burning soils, which cannot be rendered more fertile by this operation. Chemistry, in this manner, I have no doubt, will be found to confer material practical benefits to those who avail themselves of its aid. It cannot be expected that every farmer should himself be a good chemist, were it desirable or necessary; but we may justly demand of him that he should properly appreciate the labours of those engaged in chemico-agricultural researches. Without a knowledge of the first principles of the science, however, the practical man will never be able to appreciate properly the aid which chemistry is capable of conferring on him, nor will he fully understand the direct bearing which chemistry exercises on many practical operations. We would therefore recommend the study of the principles of the science as the foundation of true agricultural progress.

7. What are the causes of the failure attending over-burning?

When clay is burnt too strong it becomes hard like stone, loses much in porosity, and does not crumble to powder on exposure to the air. To these mechanical changes, no doubt, the failure of over-burnt clay partly must be ascribed. I say only partly, because Professor Johnston has already shown that, in over-burning, the constituents of clay are rendered less soluble than they are in the natural clay. My experiments fully confirm the Professor's observations. I have further found, that over-burnt clay does not absorb so much ammonia from the atmosphere as properly burnt clay, which is easily explained by the diminished porosity, and consequently diminished absorptive power, of such clays. The cause of the failure attending over-burning, then, must be sought—1st, In the mechanical changes clay undergoes in over-burning; 2d, In the chemical changes which render such clays less soluble; and 3d, In the diminished power of absorbing gases from the atmosphere.

8. Does moderately burnt clay absorb more ammonia from the atmosphere than clay in its natural state?

It will be remembered that many chemists and agricultural

writers ascribe the advantages of burnt clay to ammonia, which, according to their views, is absorbed from the atmosphere by it in that state more extensively than when it is unburnt. In order to put this theory to the test, I made the following experiments with—

1. Clay from Huntstile, near Bridgewater, in its natural state, (the same as that used in the above analyses, marked No. I.)

2. Clay from the same locality moderately burnt (the same as that used in the above analyses, marked No. II.)

Both portions were moistened with water, and exposed in glass beakers to the atmosphere for a period of two months and twelve days, without, however, renewing the evaporated water. After that period the quantity of ammonia in each sample was determined by combustion with soda—lime in the usual manner. The following are the results:—

(1.) Clay from Huntstile, in its natural state. 239·15 grains, on combustion, furnished 4·94 grs. of bichloride of platinum and ammonium, or

100 parts of air-dry clay contained 0·240 per cent of ammonia (NH_4O).

(2.) Clay from Huntstile, moderately burnt. 210·15 grs., on combustion, gave 0·36 of bichloride of platin. and ammonium, or

100 parts of air-dry clay contained 0·019 of ammonia (NH_4O).

The clay, when unburnt, it will be observed, furnished a much larger quantity of ammonia—the same after moderate calcination. We must, however, not conclude that unburnt clay possesses a greater power of absorbing ammonia from the atmosphere; for the ammonia contained in the analysis is partly the result of the decomposition of nitrogenised organic matters which existed in the clay, and which were destroyed on burning.

At all events, the above analyses shows that unburnt clay contains ammonia, or the elements from which ammonia is formed, in larger quantities than burnt clay. For that reason I cannot attach much value to the ammonia theory.

9. Does over-burnt clay absorb any or no ammonia from the atmosphere?

Sprengel, as has been mentioned before, thinks that in over-burnt clay no ammonia can be produced. The following experiment will show with what amount of confidence this doctrine is to be accepted.

A portion of over-burnt clay from Huntstile, the solubility of which, as proved by the above analysis, was considerably smaller than that of properly burnt clay, was exposed to the atmosphere, moistened with water, for two months and thirteen days. The amount of ammonia was then determined in the same manner as in the preceding experiment.

219 grs. of air-dry gave 0·155 grs. of bichloride of platinum and ammonium, or

100 parts furnished only 0·008 per cent of ammonium.

We thus find that Sprengel's theory is not borne out by direct experiment; but, at the same time, we see here that the power of absorbing ammonia in over-burnt clay is considerably reduced.

Moderately burnt clay will absorb double the quantity of ammonia from the atmosphere which will be absorbed by over-burnt clay under precisely the same circumstances.

10. Is ammonia found in burnt clay containing protoxide of iron, when exposed in a moist state to the atmosphere, in much larger quantities than in the same clay exposed in a dry state to the atmosphere?

In answer to this question, the following experiments were instituted:—

A portion of the same clay used throughout in all the experiments was moderately burnt in a closed crucible, after having been previously mixed with 1 per cent of charcoal powder. The charcoal powder was mixed with the clay for the purpose of reducing the peroxide of iron in the clay to protoxide.

(1.) One-half of the clay thus treated was exposed for two months and fourteen days to a dry atmosphere, in a dry state.

(2.) The other half was thoroughly moistened with water, and exposed for the same length of time to the same atmosphere.

The quantity of ammonia in each sample was then determined separately.

(1.) Clay exposed to the atmosphere in a dry state: 182·81 grs. gave 0·28 grs. of bichloride of platin. and ammonium, or

100 grs. gave 0·17 per cent of ammonium.

(2.) Clay exposed to the atmosphere in a wet state: 212·11 grs. of clay gave 0·33 grs. of bichloride of platin. and ammonium, or

100 grs. gave 0·018 per cent of ammonium.

These quantities of ammonia are nearly identical. Ammonia, accordingly, is not formed, as Sprengel supposes, by the decomposition of water under the influence of protoxide of iron and the atmosphere, in a larger quantity, in which ammonia is absorbed by dry clay from the atmosphere.

Thus, under no circumstance do we find ammonia in burnt clay in larger quantities than in unburnt clay. The effects of burnt clay, therefore, cannot be explained by the absorption of ammonia only.

11. What is the reason that burnt clay improves especially root and other green crops, as Mr Woodward states?

Mr Woodward's observation that root-crops are particularly benefited by burnt clay also receives an easy explanation from

the mode of its action, which we have explained; for we must recollect that turnips, swedes, mangold-wurzel, potatoes, &c., require much potash to mature their growth.

It may be mentioned, in conclusion, that I have determined the whole amount of alkalies which the clay from Huntstile farm is capable of furnishing, when fused with carbonate of baryta. The quantity of potash and soda present in the clay, for the greater part in a state of insoluble silicates, I find to be: Potash=4·726 per cent, and Soda=·88 per cent. As one of the characteristics of a clay fit for burning, we have pointed out the undecomposed alkaline silicates which good clays should contain. Thus, finding the proportion of potash and soda so considerable, as in this clay, we are justified in suggesting that this clay is most likely to prove very efficacious after burning. With this theoretical speculation agrees well the fact mentioned by Mr Danger, the tenant of Huntstile farm, that by burning this clay the land is very much improved. Mr Danger says: "Of course I can only speak to the fact. A soil which I have found *quite sterile*, on which this process has been used, became *totally changed*."

Having thus considered each of our propositions separately, and deduced from them what appeared to us the most prominent and legitimate conclusions, we shall conclude by merely recapitulating the principal and most practical facts which depend on them, leaving the discriminating reader to form his own opinion of the whole subject.

Summary.

1. The mechanical changes produced on clay upon burning, which by no means are *unimportant*, nevertheless do not sufficiently explain the fertilising effects of burnt clay.
2. These are dependent on the chemical, as well as on the mechanical changes, both produced upon burning clay.
3. Clay after burning becomes more soluble in dilute acids.
4. The temperature used in burning clay regulates the solubility of clay; too intense a heat renders clay, again, less soluble.
5. A temperature whereby the organic matter in clay soils is merely changed, but not destroyed altogether, should be employed in burning clay in the field.
6. On overburning, clay becomes less soluble than it is in its natural state.
7. Burnt clay contains more soluble potash and soda than unburnt.
8. Properly burnt clay furnishes a larger proportion of soluble potash and soda than clay burnt at too high a temperature.
9. In burning clay the same effects are produced as in bare-fallow.
10. The fertilising effects of burnt clay are mainly dependent

on the larger amount of potash and soda, particularly of potash, which is liberated from the insoluble silicates in the process of burning.

11. Clays originally containing much undecomposed silicates of potash and soda are best suited for burning.

12. On the contrary, those resembling in composition pure pipe and porcelain clays, and all those which contain mere traces of undecomposed alkaline silicates, are unfit for burning.

13. It is desirable that clay which is intended to be burnt should contain lime.

14. The application of quicklime to newly burnt clay land, or the mixing of clay with lime before burning, is likely to be attended with much benefit.

15. Burnt clay absorbs ammonia from the atmosphere.

16. Clay in its natural state furnishes more ammonia than properly burned clay.

17. Overburnt clay does not absorb so much ammonia as properly burnt clay.

18. The causes of the failures attending over-burning, are due:

1. To the mechanical changes which clay experiences in overburning, whereby it is rendered hard like stone.

2. To the chemical changes whereby the constituents of clay are rendered less soluble.

3. To the diminished porosity, and consequently reduced absorptive power of such clays.

19. Burnt clay improves especially turnips, carrots, potatoes, and other green crops, because it furnishes potash, which these crops largely require, more abundantly and more readily than unburnt clay.

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*Stephens' Book of the Farm.**—There is perhaps less demand for works upon agriculture than for any other class of books. To this general rule *The Book of the Farm*, now before us, seems to be an exception. Notwithstanding that its extent, and the number of its illustrations, made it necessarily a dear book, a second edition has been rapidly called for. This has been for some time publishing in parts, and is now completed. To enter into what might appear to us its merits or its demerits is quite out of the question. The public has acted as critic for itself, and has pronounced an approbation—and that, too, in a much more substantial and satisfactory manner than the mere words of a reviewer could do. Still, it is proper that the best, and by far the most successful work upon agriculture, should be noticed in the pages of this journal.

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* *The Book of the Farm*, detailing the labours of the Farmer, Farm-steward, Ploughman, Shepherd, Hedger, Cattleman, Field-worker, and Dairymaid. By Henry Stephens, F.R.S.E. Second edition. Two volumes. With numerous Illustrations. Blackwood and Sons.

It is not difficult to point out the secret of Mr Stephens' success, or the causes of the failure of other agricultural writers. The science of agriculture differs from most sciences, save perhaps that of medicine, in the wideness of its range; it embraces chemistry, physiology, geology, mechanics, meteorology, and many branches of natural history. Ignorance upon any one of these points spoils the whole; and yet how few of the writers upon farming have acquired a sufficient knowledge of them all. Not so with Mr Stephens: he is familiar with them all; and we know of no work in our language where, in particular, so accurate an account may be obtained of the leading facts of meteorology as applicable to agriculture, and of the insects that are obnoxious to the crops of the farmer. As a specimen of scientific writing intended for popular readers, we may select as unrivalled the account of the phenomena of the germination of seeds, in the second volume.

But to write a really useful and valuable book upon farming requires something more than an enlarged knowledge of the science of agriculture. A perfect familiarity with the practice, and the details of practice, is absolutely indispensable. It is owing to a deficiency in this respect that the higher class of agricultural writers before Mr Stephens have failed. Not so with him. To use the language of the country, he can "sow and stack." He has been in the habit of feeding the thrashing-mill, sowing grass-seeds and corn, grooming his own horse, guiding the plough, personally superintending field-workers; in fact, the only operation that a farm-servant has to do, and that Mr Stephens cannot do well, is riddling corn! It is this acquaintance with detail, this knowledge of science combined with judgment, industry, and habits of composition, that have rendered *The Book of the Farm* by far the most useful guide to the farmer, whether it be the young one, seeking a knowledge of practice, or the more experienced, desirous of knowing something of those sciences upon which, as is now confessed at all hands, the improved cultivation of the soil depends. Its rapid and extensive sale is a proof that the farmers are not, as is so often said, adverse to reading books, and that they read and appreciate really useful ones.

The following is Mr Stephens' own account of his qualifications for a writer of a manual of agriculture:—

After receiving what is commonly called a liberal education at the parochial and grammar schools of Dundee, under Mr Duncan, the rector, now professor of mathematics in St Salvador's College, St Andrews, and at the College of Edinburgh, I boarded myself with Mr George Brown of Whitsome Hill, a farm in Berwickshire, of about 600 acres, with the view of learning agriculture. Mr Brown was universally esteemed one of the best farmers of that well-farmed county; and so high an opinion did the late Mr Robertson of Ladykirk, the most celebrated breeder of short-horns in Scotland of his day, entertain of his farming, both in stock and crop, that he gave him permission to send his cows to the bulls at Ladykirk, a singular favour, which he extended, I believe, to no one else, with the exception of his old tenant and intimate friend, Mr Heriot of Fellowhills. I remained three years at Whitsome Hill, during the first two of which I laboured with my own hands at

every species of work which the ploughman, the field-worker, and the shepherd must perform in the field, or the steward and the cattleman at the steading; and even in the dairy and poultry-house part of my time was spent. All this labour I undertook, not of necessity, but voluntarily, and with cheerfulness, in the determination of acquiring a thoroughly practical knowledge of my profession. In my third year, when there happened to be no steward, Mr Brown permitted me to manage the farm, under his own immediate superintendence.

I then travelled for nearly a twelvemonth, soon after peace was restored, through most of the countries of Europe, and in many places I happened to be the first Briton who had visited them since the outbreak of the Revolutionary war. This excursion gave me considerable insight into the methods of Continental farming.

Shortly after my return home I took possession of a small farm on Balmadies, in Forfarshire, consisting of 300 acres. It was in such a state of dilapidation as to present an excellent subject for improvement. It had no farm-house, only the remains of a steading; the fields were nine-and-twenty in number, very irregular in shape, and fenced with broken-down stone dykes and clumsy layers of boulders and turf; a rivulet every year inundated parts of the best land; the farm-roads were in a wretched condition, and above forty acres of waste land were covered with whins and broom. The heaviest description of soil was hazel loam, some of it deep, some shallow, and all resting on retentive clay. The farm contained a remarkable feature, not uncommon, however, in that part of the country, an isolated peat bog, very deep, containing thick beds of shell marl, and enclosing a small lake, around whose margin grew aquatic plants in the utmost luxuriance. In a few years the farm possessed a mansion-house, offices, and steading, the surface was laid off in twelve fields, of equal size, and rectangular shape, to suit the six-course shift, with three years' grass; some of those fields were fenced with thorn hedges, and some with stone dykes; the impetuous rivulet, the Vinny, was embanked out; the land upon the retentive bottom was drained in the old mode with stones, but a few acres were tried with furrow-drains, filled with small stones, several years before the Deanston plan was made public by the late lamented James Smith; after the draining, the soil was trench-ploughed with four horses, the farm-roads were extended and made serviceable, and all the waste land was brought into cultivation. I made the plans of the buildings myself, and also set off the form of the fields, and the lines of the fences and roads, not because I imagined that a professional man could not have done them better, but that my mind and hands might be familiarised with every variety of labour appertaining to rural affairs. The results each year were twenty-five acres of good turnips instead of ten or twelve of bad, and fifty stacks of corn in the stackyard instead of seventeen. The rent offered for the farm before I took possession of it was £150, and after I relinquished farming it was let for nearly £400. The fee-simple arising from this increase of rent represents a sum larger than what was expended in producing those results.—*Preface*, p. x.

With characteristic modesty, *The Book of the Farm* is stated to be written for the use of pupils. Mr Stephens thinks that a book giving a narrative of all the labours of the farm, with the reasons why each piece of work and each operation are done, would save them at least a year. *The Book of the Farm* will certainly do this, but a great deal more. We will venture to assert, that there is not a single agriculturist, however experienced, and however successful, that would not be benefited by a perusal and frequent reference to its columns. Of all arts, none is so liable as agriculture to suffer from local habits of the district, or even of the farm. The necessary isolation of the business inevitably produces this. Of all the means of counteracting this, we know of none more efficacious than really practical and really scientific agricultural books. Club discussions may do much, agricultural shows may do much, travelling may do much, but a book is always at hand every winter night and every rainy day, and may do more. But, inde-

pendently of this, farming, at least as practised now-a-days, is an art founded on rational and well-known principles, and, as such, it requires and demands a literature. Its end is as important, and its cultivation as intelligent, as those of the sister art of medicine; and there is not a single practitioner of this latter who does not find it necessary to study daily in books both the theory and practice of his profession, so as to qualify him for the most efficacious practising of it. So should it be, and so is it rapidly becoming, with agriculturists.

Those not familiar with rural affairs are little aware either of the immense progress that agriculture has made of late years, or of how complex and profound an art it is. Proper drainage has, at least in Scotland, altered the climate, and amazingly increased the acreable produce. Guano has not only greatly increased the crop, but, from its portability, it has been applied where farm-yard manure could not; and by its aid turnips and corn flourish where before there was nothing but whins and alpine meadow grass. The improved mode of breeding live stock has produced races that fatten years earlier than they used to do. And the gradual abolition of open feeding courts, and the substitution of hammels and boxes, have rendered the progress of fattening more rapid and less expensive. Of these, and of the many other improved agricultural operations, Mr Stephens gives a full, a scientific, and, what is perhaps of greater consequence still, a practical account. Indeed, there is not a single labour, however minute and apparently insignificant, that can be done upon a farm of mixed husbandry, that *The Book of the Farm* does not minutely describe, and also give the *rationale* of. The subjects treated of are judiciously arranged into three divisions. In the first, the author addresses a young man determined to make himself master of the practice and principles of agriculture. He points out the various modes of farming, and the various difficulties that beset the young beginner. These, however, he assures him may be overcome, and he tells him how to do so. Mr Stephens next describes the sciences which bear upon agriculture, and, moreover, gives an account of the leading principles of each. This account, like the rest of the book, is characterised by clearness of thought, and strong practical common sense. The following observations upon the origin of mould are curious:—

Notwithstanding the possibility of the formation of mould upon the surface of hard rocks by means of atmospheric influences, there cannot, I think, a doubt exist that by far the largest proportion of the agricultural soil is based upon the incoherent, and not upon the indurated rocks. I do not profess to be a geologist in the legitimate sense of the term; but I have paid some attention to the science for many years past, and never have had an opportunity of observing the position of rocks without availing myself of it, in order to become acquainted with the loose deposits on the surface, because they evidently have an immediate connection with agriculture; and I must say that all my observations in this country, as well as on the Continent, have convinced me that the agricultural soils of the low part of a country are generally

not derived from the hard rocks upon which they may happen to be placed, but have been brought to their present position, from a distance, by means of water.

Many instances occur to my knowledge of great tracts of soils, *including subsoils*, having no relation "to the geological formation under them." The fine strong deep clay of the Carse of Gowrie rests on the old red sandstone, a rock having nothing in common, either in consistence or colour, with the clay above it. The large extent of the grey sands of Barrie, and the great grey gravelly deposits of the valley of the Lunan, in Forfarshire, both rest on the same formation as the Carse clay, namely, the old red sandstone; and so of numerous other examples in Scotland. In fact, soils are frequently found of infinitely diversified character over extensive districts of rock, whose structure is nearly uniform; and, on the other hand, soils of uniform character occur in districts where the underlying rocks differ, as well in their chemical as in their geological properties. Thus, a uniform integument of clay rests upon the grey sandstone to the westward of the Carse of Gowrie, in Perthshire, and the same clay covers the Ochil Hills, in that county and Fifeshire, with a uniform mantle—over hills which are entirely composed of trap.—(Vol. i. p. 111-112.)

In fact, this part of *The Book of the Farm*, describing the science of agriculture, may be profitably read not only by the agricultural pupil, but by the country gentleman anxious to qualify himself to take advantage of his position to improve the state of farming. Along with our author, we regret that so many of this class neglect to make themselves familiar with rural affairs.

The second division of *The Book of the Farm* is entitled Practice, and explains the detail, down to the minutest point, of every farm operation that is or may be carried on in Great Britain. He begins with those in winter, the most prominent of these being the management of the stock and the preparations for the ensuing busy season. Then come those of spring, with its sowing of seeds and reproduction of live stock. Summer includes turnip culture, and autumn the joyful harvest. In all these we have to admire the successful manner in which extreme empiricism or extreme theory is avoided. Nothing, however wild, advanced by the man of speculation, is treated with contempt, but receives a courteous refutation. No well-established practical fact is allowed to lose its weight, if assailed by any reasoning, however subtle. On the other hand, to philosophic science its due weight is allowed; and the crude and imperfect practice, perhaps, of some very limited locality is not permitted to put down the deduction drawn by the careful investigations of the chemist or the physiologist. The whole is evidently written conscientiously. The author appears to feel that he is an authority, and to be determined not to lead his followers astray. As an example of the careful and practical manner in which he treats controverted questions, we may cite his observations upon thick and thin sowing.

On the comparative merits of thick and thin sowing, experience has yet much to teach. The direct saving of seed effected by thin sowing recommends it at once for adoption; but if this advantage were all, unless the crop it produced were always good, of which there is no constant assurance, it would not produce a conviction of its superiority over thick sowing. In so doubtful a position we may safely take the middle course of sowing a moderate quantity of seed, for I believe no doubt exists of very thick sowing, as hitherto pursued, having wasted a large proportion of the seed. In sowing, any more than in other practices of husbandry, no absolute rule will apply to all circumstances; and many considerations should be taken into

account before a particular rule be adopted. I should say that farmers are generally blamable for the lavish manner in which they throw the seed into the ground, and subject themselves to considerable loss in sowing more seed than the most extreme conditions of soil and season warrant. The great evil of too thick sowing is the crowding the plants together into a space where neither sufficiency of air, or of room for their roots, are provided. A struggle for existence between the plants commences after they have arrived at the stage when their wants are of the most necessitous description, and the struggle terminates in the least vigorous ones dying off, and leaving the stronger, which would have been as numerous with thinner sowing, but which, in consequence of the struggle, have been much impeded in growth, and by which the ears and grains continue small, and yield a small return. Thick sowing is advisable on newly broken-up land, containing a large amount of vegetable matter in an active state of decomposition, when it is beneficial in repressing, by its numerous roots and stems, that exuberance of growth which produces soft and succulent stems that become lodged and produce unfilled ears. Thin sowing has a tendency to make the roots descend deep; and where a ferruginous subsoil exists, thick sowing keeps the roots nearer the surface away from it. Thin sowing develops a large ear, grain, and stem, but delays maturity. Thick sowing on old land in high condition renders the plant diminutive, and hastens its maturity before the ear and grain have attained their proper size. Thin sowing in autumn affords room to plants to tiller and fill the ground in spring, while thin sowing in spring does not afford time for the plant to tiller much. Thick sowing in autumn makes the plants look best in winter, but it gradually attenuates them as spring advances. Thin sowing makes them look worst in winter, but to become more full as the harvest approaches. You thus see that a moderate quantity of seed of the cereal grains is the most prudent practice to adopt generally; and where exceptional cases occur, as noticed above, the judgment must be particularly exercised; and, after experience has certainly established the most proper quantity for every particular case, the difficulties of sowing will be removed, and its economical benefits realised.—(Vol. ii. p. 121.)

The topics treated of by Mr Stephens are so numerous that we scarcely know which of them to select for the purpose of comment. Two of them, of first importance, and treated of at considerable length, are the management of live stock and the culture of turnips. Some points connected with these seem to demand notice. Three modes of managing cattle in winter may be said to exist. There is the old-fashioned one of open straw-yards, or courts, with turnips scattered upon the ground. This, we suppose, is now universally condemned by all better-class farmers. A second mode is to put a small number into hammels, having troughs to hold the meat; and the third is to keep each animal under cover by itself, either tied up in a byre, or in a box, as it is termed. Mr Stephens approves most of the second of these two methods.

In one respect, hammels certainly are superior to byres. Cattle in them are more easily kept clean. In byres, indeed, they may be kept clean; but this requires so much care and attention that in practice we rarely find them so. Then, hammel-fed cattle certainly are able to travel better than byre-fed; and to those between whose farm and market there is not a railway this is a matter of consideration. But, which is the most important consideration of all, it has been found by actual experiment that hammel-feeding pays better than byre-feeding. Mr Stephens quotes the experiments of an eminent and well-known agriculturist, Mr Boswell of Balmuto, both in Fifeshire and at Kingcaussie, but which are unnecessary to detail.

Mr Stephens is decidedly in favour of hammel-feeding, as contrasted with the more recent plan of box-feeding. He observes, and we think very justly, that it is very unfair of its advocates to contrast it, as they do, not with the system of feeding two or three in hammels, but with that of the confessedly bad one of putting a number of cattle in open courts. We may remark, that two of the latest writers upon the science of agriculture, Dr Thompson and Dr Kemp, have both maintained that box-feeding is a practice contrary to what physiology would teach. The latter writer thinks that, had not the evil effects of it been in some degree counteracted by the curry-combing and brushing the animals got, they would have forced themselves upon the notice of its advocates. We cannot better state the practical objections to box-feeding than in the words of Mr Stephens.

I feel the same objection to cattle being so confined when feeding, as I did to the sheep in their confined cribs and stalls ; and the question of the feeding is not to be ascribed to the boxes, but to the superior nature of the linseed upon which they are fed. Indeed, I should consider the dampness inherent to a situation dug two feet into the ground, in rendering even dry straw unwholesome in it as a bed, as having a tendency to injure the progress of an ox towards maturity, rather than otherwise ; and I am sure that exposure *at will* to the sun and air, and even rain in winter, is much more conducive to the health of an ox than constant confinement under a roof. It is true that box feeding affords much more liberty to the animal than when feeding at the stake in a byre ; but in what respect box feeding should excel small hammels, it is not easy to discover. The cost of constructing small hammels to hold two or three oxen together is not great : two is the number I would always prefer, as affording society, and avoiding contention on the one hand and loneliness on the other ; but the cost of constructing accommodation for cattle I consider a secondary consideration in comparison to affording them the greatest comfort; and greater comfort than a hammel may afford is scarcely possible to be attained by any other means, certainly not by such boxes, and the manure would be equally as well compressed and good in hammels as in boxes.—(Vol. i. p. 293.)

Mr Stephens considers that the soiling of stock during summer with cut forage is not practicable on a large scale. He forms his opinions so cautiously, and after so well weighing the evidence, that we dissent from him with great hesitation. But we are not convinced with his arguments upon this head. He denies that, with regard to the comparative extent of ground required for soiling and pasturage, the difference is in favour of the former as three to one. In this we suspect that he is right ; but he states the difference in favour of soiling as two to one, and surely even this is worth trying much for. The first objection is, that clover and rye grass are not ready to cut by the time the turnips are finished ; but we have long thought that rye-grass is by far too exclusively grown in Scotland, and even rye-grass may be forwarded a fortnight by the application of nitrate of soda. Another objection is, that a farm cannot produce sufficient straw to litter stock during the summer. To this may be said, that soiling cattle, by leaving more ground and making more manure, produces more straw. Mr Stephens has a third objection, which we suspect is even more valid—the great expense of cutting grass. After all, perhaps Mr Stephens is

concluding most prudently upon this subject in saying, "on a small scale soiling might be practised with advantage, and it behoves every small farmer to make his grass go as far as possible."

Mr Stephens is an advocate, we observe, for mowing corn instead of reaping it with the hook. As this practice has not become common, and as it is so much cheaper, we quote the opinion of so practical a man.

Every species of the cereal grains may be mown with the scythe. Many farmers still believe that the scythe is an unsuitable implement with which to mow wheat; but I can assure them, from long experience and observation, that it is as suitable as the sickle, and that mown sheaves may be made to look well, provided the gatherers are proficients at their work. Doubtless, mowing wheat is severe work, and so is reaping it. Oats are the most pleasant crop to mow, their crisp straw being easily cut with the scythe, and, being smooth and not too long, does not injure the hands in binding like wheat, and the sheaves are easily set in stook—barley straw being covered with a gummy matter, which gives it a malty smell, soon takes the edge off the scythe, and, being brittle, not hard, is easily broken in the binding. When much young grass is found among the barley-straw when mown, it should be shaken out by the gatherers while holding the straw by the corn end, as it will detain the crop too long in the field in winning; and rather than run that risk, it is better to incur the extra cost of getting rid of the grass by a little sacrifice of time at reaping, or even by the engagement of extra hands. It is scarcely practicable to shake out grass from corn while reaping with the sickle, as the instrument would constantly be required to be laid aside, both hands being required in the operation. To cut the stubble as high as the grass would make the straw in the sheaf too short. A good mower will cut one acre of wheat, or perhaps rather more, in a day. If a stroke of the scythe covers seven feet in length, and fifteen inches in breadth, an area equal to 1260 square inches, it will take about 5000 such strokes to reap an acre. Two acres of oats may easily be mown in a day, thus indicating that a man will mow double the extent of oats he will do of wheat, or make about 10,000 strokes a-day. Nearly two acres of barley may be mown in a day, time being wasted in the extra sharping required in cutting barley straw.—(Vol. ii. p. 342.)

The treatise on the culture of the turnip, in the early part of the second volume, is by far the most complete and finished agricultural essay that our literature possesses. To those who have been in the habit of adopting the Northumberland mode of cultivation of this crop, which is the foundation of all good husbandry, we can confidently recommend it as descriptive of all that is known of the subject, and as also suggestive of farther improvements, which, to those who, as in many parts of England, have not yet followed this method, we can offer it as a description of it, so full, clear, and practical, that no one can misunderstand it. We cannot help thinking that those who accuse the agricultural mind with want of activity would do well to consider what has been done with regard to the turnip, and to contrast it with the advance made by any other art whatever. We will say nothing of the original production by art of two such valuable vegetables as the cabbage and the turnip from one and the same wild plant, the marine brassica. Neither will we expatiate, as we might do, upon the constant addition of fresh varieties of turnips, each characterised by peculiar and valuable properties. We will confine ourselves to a simple statement of the great and rapid improvements made in the farming of the Lowlands of Scotland during the

last seventy or eighty years, and of which improvement the amended culture of the turnip is the foundation.

Seventy years ago, on a Lothian * farm, two or three per cent only would be under a turnip crop, and even then the turnips would be sown broadcast. Now, twenty-five per cent are devoted to this crop. The consequence of this is, first, that on a farm where some five oxen would be fattened, eighty now are; and, as a necessary sequence, where five acres were dunged, now eighty are; and probably more than four times as much corn is raised. The agriculturist has necessarily risen in social standing; and, unlike many other classes who have done so, he has taken care that the condition of his servants shall be improved as well as his own, and his ploughmen and other labourers are better housed, better paid, and better fed than they were seventy years ago. His success, the result of his skill and his energy, has even extended to improving the condition of his beasts and horses.

Mr Stephens starts a curious point with regard to the quantity of seed sown in the field culture of turnips. Every practical man must have been struck with the immense number of seeds sown, as contrasted with the number of plants obtained. Our author has taken the trouble to estimate the amount of seeds that are wasted, and he finds that, out of every twenty-seven seeds sown, only one becomes a mature turnip. This loss is far too great to be wholly attributed to birds or insects. Some of the seeds sown have often, doubtless, lost their vitality; but the explanation given in *The Book of the Farm* strikes us as being as true as it is original. In order that any seed may germinate, it is essential that it be in contact with a certain amount of oxygen, which oxygen is contained in the atmosphere. In other words, it must be sufficiently near the surface to allow the air to have access to it. The amount of oxygen necessary for germination varies in different families of plants. Probably those seeds that contain oil in place of starch require the greatest. Any way, it is a certain fact that the seeds of the cruciferous plants, if buried even a very few inches, will not germinate. And Mr Stephens suggests, that in all probability our common turnip drilling machines deposit the seed far too deeply. This, if found by practice, as we have little doubt it will, to be correct, is an important observation, not for the sake of saving seed by enabling the farmer to sow less, but because it is of the greatest importance to obtain an abundant braird so as to enable the young crop to resist the injurious attacks of insects.

Too little attention is perhaps paid to the singling of turnips. A difference of two inches, will make a difference of more than ten tons to the acre of bulbs.

For example, (says Mr Stephens on this subject,) 5 lb. turnips, at 7 inches asunder, give a crop of 57 tons 12½ cwt.; whereas the same weight of turnip, at 11 inches

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* See some interesting papers recently published in the *North British Agriculturist.*

apart, gives only a little more than 47 tons. Now, how easy it is for careless people to thin out the plants to 11 instead of to 9 inches; and yet, by so doing, no less than 10¼ tons of turnips are sacrificed. Again, a difference of only 1 lb. on the turnip—from 5 lb. to 4 lb. at 9 inches asunder—makes a difference of 11½ tons per acre. So that a difference of only 1 lb. in each turnip, and 2 inches in the distance between them, makes the united sacrifice of 21 tons per acre! Who will deny, after this, that minutiæ require the most careful attention in farming?

Unless in very rich ground, the distance recommended is 12 inches between the plants for swedes, and 9 between those of yellow turnips and globes. In the operation of hoeing, a portion of the stem is drawn out of the ground, and it is this portion that afterwards becomes the bulb. The following extract represents a pretty picture:—

One summer I superintended 16 field-workers, and they singled about 90 imperial acres in 8 days of 10 hours each, which was equal to 2 roods 32 poles a-day to each worker. This is above the average rate of work, but the weather was exceedingly fine all the time, the land mellow and dry, the plants of a proper age, whether of swedes or of white globes, and the women were all experienced hands. I set one of them, a steady hand, to lead the band, whom she carried on like clockwork. She herself preferred to work with a hoe only 33 inches in length, which allowed her to bow down to her work, which she performed, in consequence, in the most perfect manner. The hoes of the rest were 36 inches in length. A rest of 20 minutes was given them at each mid-yoking. If the time occupied in resting be deducted from the 8 days, the work done was exactly 3 roods to each worker every day. To save fatigue in walking home at the end of the mid-day yoking, they brought their dinners to the field, consisting of barley and pease bread and a bottle of milk. I took my bottle of milk and loaf of home-made bread to the field, and enjoyed the repast at the hedge-root with genuine relish in as light-hearted company as ever undertook laborious work.—(Vol. ii. p. 69.)

Our lengthening columns, however, warn us to pass on to the last division of the work, entitled Realisation. Here we are again struck with the thoroughly practical nature of Mr Stephens' book. He has here, too, a greater opportunity than he had before of exhibiting a love for his profession, and a highness of moral feeling, which are equally characteristic of him. How extensive and varied has been his reading and reflection may be inferred from the following list of subjects treated of:—Physical geography of farms—climate—judging of land—estimating rent—mode of offering for a farm—negotiating about the lease—entering a farm—stocking it—building the steading—farmhouse—servants' houses—insurances against fire and disease—enclosure and shelter—thorn hedges—stone fences—iron do.—embanking against rivulets—field gates—draining—improving waste land—trench and subsoil ploughing—liming—irrigating—the treatment of draught stallions—breaking-in young draught and riding horses—training the shepherd dog—slaughtering—the points to be aimed at in breeding—the breeds of cattle and sheep—the principles of breeding—the selection of parents, crossing—breeding in-and-in—the hiring and wages of farm-servants—the farm tradespeople—the care of implements—making experiments—corn-markets—book-keeping, and some very judicious exhortations to the young farmer.

It is impossible for us here to attempt to do justice to even any of the above-mentioned topics. We prefer making the following extract from the observations of Mr Stephens at the conclusion of his book :—

In his bearing to his own people, the farmer should always show them kindness, and if he have ever to change his conduct towards them, it should be from some fault of theirs, not his. He should not find fault continually, as constant rebuke produces no reformation, but rather indifference. A fault should generally be checked; but those arising from the head, and not the heart, should be gently dealt with. Theft and falsehood should never be pardoned, and the delinquent should be got rid of at the end of the term of service. Such a step is necessary for checking the spread of moral contamination. When a ploughman is seen to quarrel seriously with his horses, the safest expedient for both man and horse is to cause him to unloosen them from the yoke, and put them in the stable until the next day, when his temper will have calmed down. Even severe rebuke at the time, with allowance to continue at work, will never convince him that he was wrong and the horses were right, although that is the more probable state of the case. The wives and children of married men are frequently troublesome about a farm. Whenever it is seen that a man cannot control his own household, he should be parted with at the expiry of the term. Much more work will be obtained from field-workers by kindness than by severity.

The farmer ought to be punctual in his payments to his servants at the specified terms. He who neglects to pay them regularly loses control over them, and actually places himself in their power in many ways. . . . .

In his relation to his neighbours, the farmer should be most punctual to his engagements. If he has promised to buy or to sell any commodity with a person on a given day, he should faithfully keep his appointment. If he has promised to settle accounts with any one at a given time, he should do so without fail. A very few breaches of promises will attach an unenviable reputation to his name in that part of the country where he resides, and a few more such may entirely ruin his credit. . .

The farmer should provide recreation and instruction at home—recreation he may find in his own family, and occasionally in visits with and from friends at a distance and neighbours at hand; and for instruction, he must have recourse to books and papers, and partly to the converse of friends and strangers. If he provide not these attractions at home, he will go where they are to be found, and neglect the concerns of his farm. It is a common remark by townspeople that farmers, as a class, are averse to reading. If they knew the habits of farmers as well as I do, the observation, even if strictly true, would be no obloquy. Little do townspeople know the weight of fatigue which early rising and constant exercise in the fields on foot—which the farmer is obliged to take in summer who has improving operations to superintend—impose, and of the lassitude which overtakes the frame when resting in the evening after the fatigues of the day. It is then physically impossible for any man to betake himself to reading a subject that requires thought and reflection, or any subject at all. The desultory newspaper affords the most fitting literature to his mind, until the hour for bed, which must be early. No one has a higher relish for reading than myself, and yet I have seen a whole summer slip away without having read anything but the newspapers. In winter it is different, and in that season it is not true that the farmer does not read, for many read much; and as a farmer advances in years, and takes less exercise, his leisure is greatly devoted to reading. We have only to peruse the discussions in the Farmers' Club in England, and at the monthly meetings of the Highland and Agricultural Society in Edinburgh, to be satisfied that the present race of farmers read, and have read to good purpose. Townspeople believe that the artisans of towns are more intelligent than the labourers of the country. I have had many opportunities of conversing on miscellaneous subjects with both classes of work-people, and never could observe the superior intelligence of the town artisan. I am sure the grocer's shopman does not know the countries from whence the various articles he deals in come, nor the processes by which the articles are prepared for the market, except it may be the art of adulteration. The journeyman cabinet-maker knows as little of the countries which supply the different kinds of ornamental wood. It is the same with other trades. The country-labourer is, at least, observant of everything around him; he knows the weather, different kinds of soil, different kinds of rock, different kinds of trees, the habits of plants and animals, and can discriminate

individual character very shrewdly. The intelligence of the manufacturer too is often placed in favourable contrast with that of the farmer, and the usual example of superiority is adduced in the manufacturer availing himself immediately of every improved piece of machinery, while the farmer is represented as neglecting similar opportunities for improvement in his business. The cases are not at all analogous. The manufacturer knows with certainty that the machinery which will suit a similar manufacture to his own at one place will suit his purpose also, but the farmer has no certainty of an implement suiting a district of the country altogether dissimilar to his own in climate, soil, situation, and locality, answering his own. He prudently waits the approval of others before he adopts it in his own business, which is always materially affected in its results by the slightest change of the elements. I would put the case of the manufacturers and farmers of this kingdom in this way :—The British manufacturer is situated in the most favourable circumstances for the prosecution of his business, with coal, machinery, conveyances, and seaports ; the British farmer is not, in regard to soil and climate. The foreign manufacturer is not placed, in those respects, in the most favourable circumstances for the prosecution of his business; the foreign farmer is. And yet the foreign manufacturer is equal as to the production of marketable goods to the British manufacturer, while it is acknowledged on all hands that the British farmer is superior in every respect to the foreign farmer in what relates to the cultivation of the soil and the rearing of live stock. In comparison, therefore, with foreign compeers, the British farmer stands in a much higher position than the British manufacturer.

In catering for his mental food, the young farmer should not neglect to take the periodicals connected with the great agricultural societies of the kingdom. The best works on agricultural chemistry and physiology, both animal and vegetable, should not be neglected. His own local newspaper he of course always patronises, and I think that he should procure besides a London agricultural newspaper, on account of the fulness of the reports of the numerous markets of the kingdom, as well as foreign ones, which they always contain.

In conclusion, I would exhort the young farmer to maintain that independence of mind and judgment, which is not only honourable and becoming, but a positive duty to the very important class of which he is a member. Let him never forget that he belongs to a profession which has been recognised by those best entitled to form an opinion on the subject, as contributing in no small degree to the maintenance of the constitution and liberties of these islands, and that he is bound by every means in his power, whenever the occasion may present itself, to discharge the functions of a loyal British subject. In parting with the young farmer, I do not know that I can better conclude than by exhorting him to maintain, in his own person and in his own sphere, the high, manly, and independent character which for centuries has been acknowledged as the attribute of the British agriculturist. And with an anxious and heartfelt hope that my labours may prove profitable and instructive to some of my younger brethren, and be considered by the more experienced as tending to illustrate the science of agricultural economy, I conclude my task.

With this quotation we shut the *Book of the Farm*, unquestionably the most important gift ever bestowed by literature upon practical agriculture.

Ground-Work.—By Mr David Gorrie, Annat Cottage, Errol. —It is but seldom that the natural surface of a landscape garden can be improved by art; and in planning and executing necessary ground-work, it is often the chief consideration how the natural contour may be best preserved uninjured. In building a house on the side of a hill, or on the summit of a knoll, it is necessary so to alter the ground as that the house may seem to stand on a level platform ; but, in most cases, this would be best effected by means of an architectural terrace, which, while it would afford the platform required, would, at the same time, refrain from interfering in a harsh manner with the natural surface-lines. It has

afforded subject of dispute to decide whether the architect or the landscape-gardener should first be employed, when it is designed to erect a new residence on ground previously waste or devoted to the plough; and some have endeavoured to solve the difficulty by advocating the practice of both professions by one and the same individual. But when the grounds are extensive, and the intended building of a large size, a division of labour will be found most profitable and most effective. With regard to the position of the house in reference to surrounding objects, the landscape-gardener ought of course to be consulted; but it might be better, in the generality of cases, were the architect to be left to provide suitable standing room for the edifice which he has planned. This would oblige him to revert to the old-fashioned architectural terrace, the sweeping away of which, at a certain period in the past century, when the art of landscape-gardening was in a transition state, was accomplished because the rage of fashion would have it so. The loss of the wall, the gateway, the drawbridge, and the moat, may be lamented by the antiquary, but the loss of the terrace must come home to every person of cultivated taste. When the bare and bald perversion of the natural style came into vogue—when the house was made to stand in the middle of a smooth lawn, with closely shaven grass up to its very walls, and with its kitchen-offices concealed in a sunk story to be out of the way, and when no connecting link between the architectural and other objects in the landscape was left—then it was that a reaction commenced, and men, tired of sameness and baldness, were found ready to listen to the advocates of the picturesque style, in some parts of which things were carried to an opposite extreme. One of the chief errors of the tame style was the banishment of the terrace, and the attempt thus rendered necessary to provide a platform for a house by altering the contour of the ground, and this in such a way as to hide the hand of art. Seldom was this done effectually. The surface-line generally became less and less beautiful the more it was altered. In all naturally undulating surfaces, the line of beauty is of frequent occurrence, and it is easily destroyed by the spade and the shovel, but may still exist in imagination, though in part interrupted by architectural objects. It is, therefore, unadvisable to alter the surface-line of ground. This line may, in some cases, require improvement. Deformities may be removed when they exist near a house, although, when at a distance, it is easiest to hide them by trees. Valleys may sometimes be deepened, and rising grounds heightened, with good effect; but a safe rule in either case is to follow the model of nature, without attempting to remodel or change.

Circumstances will point out when and where a terrace is required. Utility, as a principle, should be acknowledged in every line or angle. There are terraces, or rather *terracings*, in existence,

which have actually been formed on a level surface, and consist of grassy hollows, artificially formed, and with their sides cut into steps of all imaginable shapes and dimensions, the only apparent object of which is to put the scythesmen out of humour when mowing the grass. It may be said that this is a matter of taste; but, verily, there is no taste in the matter. Childish frippery and irrational mimicry can never deserve to be dignified with the name of taste. Where the level of a piece of ground is lowered for the express purpose of obtaining a suitably damp soil for rhododendrons and other American shrubs, then a surrounding terrace-walk is useful and appropriate, because from it the best view of the beds of shrubs may be obtained; but to descend to the level of these beds, stone steps at two or more places will be found sufficient, and the sides of the terrace may be formed of an easy slope, and either planted with shrubs or laid under grass. A platform in front of or around a house may be so extensive as to include the flower garden, or it may at least be decorated with flowers, unless the views from the windows are so grand and inviting as to render unadvisable the introduction of objects in the foreground which might distract the attention. The terrace-fence, whether flowers be within it or not, will mark the line of separation between the ground depastured by sheep, deer, or cattle, and that in the immediate vicinity of the house, to which they ought not to obtain admission. A wire-railing is but an unsatisfactory fence in such a situation; it may possess strength, but it lacks the appearance of doing so. The terrace-wall or balustrade is not only a sufficient fence, both in appearance and reality, but it serves also to carry the eye over the objects immediately beyond it towards the more distant scenery, and creates a certain degree of intricacy by concealing part of the lawn from view. Repton advocated the cause of the architectural terrace at a time when the current of fashion was running strongly against everything of the kind, and he considered this as a "very important part" of his practice. The distance of the terrace-fence, or edge of the platform, from the house, must be determined partly by the size of the house itself, and partly by the character of the adjacent ground. Where the ground falls from the house, the edge of a broad terrace will hide too great a breadth of the park from the eye; where it is level, a greater breadth of platform may be allowed; and where it rises beyond the terrace, the platform, in as far as the view from the windows is concerned, may be increased in breadth at will, only there should be some extent of level ground outside the fence or balustrade before the surface begins to swell. The architectural character of the terrace retaining-wall will of course be determined by that of the house itself. Its height will be regulated by the breadth of the platform conjointly with the number of cubic yards of available earth which may be dug from the foundations of the house. The levelling of the earth is one of

those operations in landscape-gardening which may be best and most cheaply performed by contract. Those operations which are connected with the management of living organic objects, such as the planting of trees and shrubs, require more care than a contractor can be expected to bestow; and it will be found best, in the end, to commit them to the charge of resident servants.

Ground is a ponderous material, and can only be operated on to a limited extent. In the ancient style of gardening a striking effect could sometimes be produced by slight means. The old-fashioned mounts which, in the words of Leland, were "writhen about by degrees, like turnings of cokil shell, to come to the top withoute payn," cost some labour in their formation; but their peculiar kind of beauty was perfect; and as long as they were preserved, their artificial origin was unmistakable; and those who had designed and constructed them could not fail to get credit for what they had accomplished. It cost no little trouble and expense, on the introduction of the modern style, to efface the lines of the ancient mounts and terraces, and to restore the ground to its natural shape; and though, when this was accomplished, the immediate effect may have been pleasing, it could only be enjoyed by those who had seen the ground in both conditions—before and after its reformation. The ancient manner of connecting the level platform on which a house stood, with the natural surface, when the ground sloped from the house in every direction, was sometimes marked by a succession of levels and slopes, decreasing in breadth and depth as they receded from the building, till at last art was lost in nature. The revival of such a mode of dealing with ground is certainly undesirable; and it is fortunate that the architectural terrace affords the means of connecting a house with its grounds, without resorting either to the ancient slopes and platforms, or the more modern extreme of preserving the natural shape of the ground up to the base course of the walls. The retaining wall, instead of the grassy slope, forms the most congruous boundary to a necessary platform of earth in the modern style of gardening, and might have been introduced into the ancient style with advantage, instead of inclined planes covered with grass, the existence of which showed an interference on the part of art with those materials which, speaking generally, ought to be left in their natural position.

The natural surface-lines of ground are flowing or undulating, and its forms are undefined. The exact point where the convex ends and the concave begins, cannot be determined. In all that relates to ground-work in the modern landscape garden, the landscape painter may be consulted as one well able to give advice. Although it is impracticable, on any large scale, to create beautifully undulating surface lines on ground where they do not

naturally exist, still something may be done, in many cases, to improve natural beauties, by removing accidental deformities, and by deepening valleys or heightening elevations, so as to remove dullness, and aid in rendering such features more expressive. In a piece of ground of a level character there may be some hollows to fill up, or some irregularities to remove in order to render the scenery artistical, while the main natural features are not interfered with. The natural lines and forms of the ground may require *polishing;* and this may be effected, while all the time art remains an unseen worker. In undulating ground the lines are either convex or concave; and in broken ground, they are horizontal or vertical, curved or inclined. The first thing to be done by the *polisher* of ground is to study what nature has already done, and to act agreeably thereto, so as that the scene, when its improvement is completed, may be congruous, and not opposed in its features to the surrounding and unaltered natural features of the landscape. The experienced leveller or surveyor, who has accustomed himself to judge of the appearance which groundwork will present after it is finished, and this before operations are commenced, will have no difficulty in giving instructions to the workmen, with the help of poles or stakes, or pits dug here and there as guides; but should his employer wish to have tangible evidence of the future effect, before being at much expense in the matter, it may be necessary to make one or more full-sized sections across the ground, bringing stripes of a few feet in breadth to the contemplated shape. This will not be required where only a few accidental deformities require removal. When earth-work on a large scale is contemplated, the effect may be foreshadowed by means of the pencil, two drawings being made, one of the ground as it is, and the other as it will appear. The pencil is a ready agent in communicating ideas in all the departments of landscape-gardening—in ground-work, the formation of sheets of water, planting or cutting down of trees, and the position and arrangement of buildings. By the aid of drawings, the proposed effect may be exhibited without having to lay down strips of white sheeting to show the effect of water, or to raise frames covered with boards to show the effect of buildings. The landscape-gardener should be able to *imagine* future effect without such auxiliaries; and to embody his ideas on paper with the help of the pencil, for the satisfaction of his employer. It may, however, be advisable to place poles of a known height in certain situations, to enable the eye to appreciate heights, sizes, and distances. Deformities which require removal are chiefly of artificial origin. In an English landscape there may be hedgerow mounds to level, and the earth thus procured may serve to embolden the expression of neighbouring rising grounds. Marks of ridges may require to be effaced, and open drains to be covered in. Old pits and quarries, by being planted, may add to the

intricacy of picturesque scenery; but in the polished scenery near a house, it is best to fill them up, and so restore the natural features of the ground. Where ground has been much broken by art, and where picturesqueness is sought for rather than polish, the straight lines of art being effaced, the scene may be rendered rich and intricate by plantations of trees and shrubs in irregular masses; but in this case ground-work will consist in deepening, widening, and heightening, rather than in filling up and levelling. Such a scene will require rough verdure, long grass, and large growing native herbs, as well as trees and shrubs, to complete its effect; but from the windows of a residence all this would appear incongruous, however much the landscape painter may be indebted to roughness in the foreground for the effect of his picture. It was a vain attempt on the part of the lovers of picturesque gardening, to unite the arts of landscape-gardening and landscape-painting so far as to create a rugged and wild foreground under the windows of a house. It was landing at the opposite extreme from the smoothness of gravel and bare grass: the happy medium, as has already been hinted, will be found in the terrace-wall or balustrade.

When very slight irregularities occur in natural ground, they may sometimes be effaced by the plough or spade in preparatory fallowing or trenching. Greater inequalities may require polishing, if near a house; but an attempt at removing them might injure the natural contour of the ground. Sometimes restoration is necessary; for when ground has been long under cultivation by means of the plough, the hollows will be partly filled up and the heights somewhat lowered. By restoring to the elevations the earth which they have lost, the scene will be rendered more expressive; and, besides this, the soil will be more equalised in depth and fertility, and there will be less probability of having grass of various hues in different parts of a lawn, dark-green in some places, and scorched to brownness with the drought of summer in others. Deformities in distant parts of a park may be more easily hid than removed; and if concealed by planting, their existence is rendered harmless. Old quarries, while hid from general view, may sometimes be formed into recluse scenes of great beauty and interest.

In forming approaches, it is often necessary to make cuttings in some places, and embankments in others. A road is an artificial object, and it is in general best that an avowal of art should be made. Where a cutting is made through rocky ground, it is better to leave the banks steep and abrupt, than to form them of an easy slope to be smoothly turfed over. A rugged chasm, even though artificial, forms a pleasing contrast to the smooth flowing lines of the neighbouring surface, and does not interfere so much with the expression of the natural ground-lines as a wider and more smoothly finished artificial hollow would do. In all exten-

sive cuttings or embankments, it is safest to avow the agency of art; and if it be considered that art is thereby rendered too intrusive in the landscape as viewed from any particular point, her works may be hidden from any such point by planting. In some cases, where a cutting is very shallow, an artificial valley may be formed by sloping back the sides concavely; and this might be managed, with the aid of trees and shrubs, so as that the road might appear to wind along a valley formed by nature. Too great an interference with the natural ground-lines would be made were deep cuttings to be so treated. The lover of Alpine plants, and wild trailing and creeping flowers, will know well how to make the steep sides of a chasm through rocky strata interesting.

Although in general the most pleasing effect will be produced in a landscape naturally rather tame than bold, by deepening the valleys and conveying the earth so obtained to the heights, yet it may happen that, by removing a few feet of earth from the summit of a ridge that intercepts the view of a distant landscape, that view may be increased in extent and interest. At one of the places which he improved, Mr Repton opened up a view into a romantic glen, by removing a small quantity of earth from the summit of an intervening ridge. Advantage may be taken of an exceptional case like this, without at all acknowledging the rightness of the practice, at one period adopted, of lowering every hillock and filling up every hollow, till at last there was nothing but smoothness and vapidity; and none of those broad contrasts, flowing lines, and undulating forms, which, in the words of Mason, "play through the varied canvass" of the true landscape painter.

A general and a safe rule in executing ground-work is to conceal art by planting, or else to avow art boldly and unmistakably; or furthermore, never to attempt imitating or improving nature without doing so in a complete manner, so that in after-times there may be no manifestation of any artificial interference. In forming lakes or rivers, nature must of course be copied; and this in the minutest details; such as having low and concave shores around the edge of a bay or advancing curve, and abrupt or steep banks to the convex side of a bend in a river, or to a cape or advancing headland. When ground has to be altered in any way, the first thing to be done is to draw a sectional plan, or a plan with dotted lines across it so as to divide it into squares, and with shaded spaces to show the height of corresponding imaginary lines on the ground above the lowest level thereof. Poles placed at the corners of the squares or intersections of the lines will enable the designer or contractor to transfer, in imagination, these squares and lines to the ground which is to be operated on; and suitable markings on the plan, and also on the poles, will form guides in carrying on the spade-work.

These helps are especially necessary when a valley has to be deepened in order to form a river or lake; or when a piece of irregular ground has to be levelled, or formed into a regularly sloping plane, for a kitchen garden; and also in the formation of bowling-greens. The common mode of planting trees interferes with the natural expression of ground. Planted too deeply, as they generally are, trees, when they grow up, seem to be inserted in the ground in the manner of poles, with no *base* to stand upon. The collar of a tree growing in a natural forest is always seen above ground; and the large root-limbs diverge from the stem with an easy curve, and are lost under the turf imperceptibly. It is of importance to copy this in lawn planting; and it can only be done by planting the trees at first in a very shallow manner—so shallow as to render it necessary to raise a low convex mound of earth that their roots may be covered. Many a fine lawn tree loses the half of its beauty because of the abrupt manner in which the stem rises from the level ground; and no tree having its collar or point of junction between the stem and the roots sunk under ground, can remain long in a healthy state, or be fitted to withstand the hurricane. Cowper's favourite elms owed part of their beauty to those brawny diverging roots, which, seen above ground at their junction with the stems, gave the trees an appearance of stability:—

> "Fast rooted in their bank,
> Stand, never overlooked, our favourite elms,
> That screen the herdsman's solitary hut."

*Johnston's Notes on North America.** (Second Notice.)—We now recur, as we promised in last Number, to Professor Johnston's most useful work; and we are induced to do so, not less by the important nature of its contents than by the wide reputation it has already acquired on both sides the Atlantic. Constrained by our limits to be brief, we select but two subjects for comment in this notice; and if the first of these be only useful for warning, or as a matter of curiosity, the second at least will be found to afford some useful information on a branch of culture which is likely every year to increase among us.

The first subject we mean to notice is one by no means complimentary to Brother Jonathan; but we are not seeking to be witty at the expense of truth when we say that one of the most prominent, and certainly not the least remarkable, features of American agriculture is its *Weeds*. Yet for their *introduction*, at least, we of the Old World are by no means irresponsible. Strange as it may seem, the prevailing weeds of the Atlantic coasts and river-borders of North America owe their origin to the fre-

* *Notes on North America.* By J. F. W. JOHNSTON. 2 vols. Blackwood and Sons. 1851.

quency of intercourse with European countries. The common plantain was called by the Indians the White-man's-foot. The Canadian or creeping thistle—which, as the pest of North American farms, has won for itself the cognomen of the *cursed* thistle—is also an importation from Europe. The lines of the poet, descriptive of the first settlement of the Pilgrim Fathers in the New World—

> The wheat came up, and the bearded rye,
> Beneath the breath of an unknown sky,

are also applicable to less useful imports than the cereals. According to Agassiz, all the plants growing by the roadsides are exotics. "Everywhere in the path of the white man," says he, "we find European plants; the native weeds have disappeared before him like the Indian. Even along the railroads (which penetrate through the solitary places of the country) we find few indigenous species. On the road between Salem and Boston, although the ground is uncultivated, all the plants along the track and in the ditches are foreign." "Would it be irrational in an Indian to suppose," says Mr Johnston, "that these European weeds in the ditches of the Salem railroad had actually followed the footsteps of the Irish emigrants who dug them? May not the seeds of them have been actually shaken from the shoes of the newly-arrived immigrants?" How interesting are the reflections suggested by these facts! And when we read of the not unfrequent indolence and usual political discontent of the Hibernian emigrants, (which latter, says our author, is one source of the present dissatisfaction of our Provinces with the Home Government,) we cannot but regard the sowing of these seeds as a true emblem, and that the very dust of an Irishman's feet is too often pregnant with mischief.

The stiff clay lands of the North-eastern regions of America are specially infected with two species of golden rod, (*Solidago canadensis* and *S. altissima*,) both of them troublesome weeds, but the former especially difficult to extirpate. For these pests to the American farmer, however, we of the Old World are not to blame, as neither of them is known as a weed in Europe. The only European species is the *Solidago virgo aurea;* and as it is a native of America also, it was already in existence there before ever the little "Mayflower" left the shores of England. It is evidently a very prevalent weed both in the British Provinces and in the northern districts of the Union, and in the State of New York no less than two-and-twenty species of it are already known.

In regard to the next weed, we are by no means so free from the imputation of blame; but it seems to have picked up in the Canadas an insubordination to Acts of Parliament which savours more of the country of its adoption than of the land of its birth:—

Everywhere in the provinces, and in New England, the Canadian thistle is heard of as the pest of the farm. It is our common creeping-thistle, *Cnicus arvensis*, or

Circium arvense, which has found a most congenial climate in North America. The common spear-thistle is a troublesome weed, but, being a biennial, can be extirpated with comparatively little labour; but the Canada thistle is perennial, has deep and wide-spreading roots, is very tenacious of life, and commits its seed annually to the winds, and thus defies the labours of individual farmers. Only a general spread of cleanly husbandry will extirpate it from a district in which it has once established itself. Even legislation is disregarded by this rebellious plant. A few years ago (1847) the New Brunswick legislature passed an act, entitled "*An act to prevent the growth of thistles*," which was limited in its application to the county of Gloucester; but the refractory weed has since only spread the more, and given increased annoyance even in the county the act was intended especially to benefit.

The last American weed that we shall notice is a very formidable one—the Corn-gromwell or stone-weed; and we think the more negligent portion of our own farmers may well learn the value of clean fields and careful culture, from seeing the lamentable but natural results of the opposite system:—

The *Lithospermum arvense*, Corn-gromwell or stone-weed, (called in North America by the various names of pigeon-weed, red-root, steen-crout, stony-seed, and wheat-thief,) is said to be a European importation, brought in probably with unclean seed-wheat from France, or Germany, or England. Thirty years ago, it was almost unknown; now in many places it usurps the ground, and especially over-runs the districts which have been accustomed to the growth of wheat. But it is a punishment which has followed the practice of the ignorant and slovenly farmer, who has paid little attention either to cleaning his land at all, or to the right way of doing it, and who has continued for a series of years to take successive crops of wheat from the same exhausted fields.

The peculiarity of this weed consists in the hard covering with which its seed or nut is covered; in the time at which it comes up and ripens its seed; and in the superficial way in which its roots spread. The hardness of its covering is such that "neither the gizzard of a fowl nor the stomach of an ox can destroy it," and that it will lie for years in the ground without perishing, till the opportunity of germinating occurs. It grows up very little in spring, but it shoots up and ripens in autumn, and its roots spread through the surface-soil only, and exhaust the food by which the young wheat should be nourished.

It is evident that a weed of this description will remain a source of trouble for many years, even to an industrious, careful, and intelligent farmer; and that spring ploughing will do little good in the way of extirpating it, as at that season it has scarcely begun to grow. It is said that, when it has once got into the land, two or three successive crops of wheat will give the pigeon-weed entire possession of the ground. And Professor Johnston expressly says that this weed has of itself been a prime cause of the failure of the wheat-culture of America, in districts where wheat used formerly to be abundantly productive; that infertility there has not been caused merely by the exhausting effects of successive grain-crops, but because these successive crops, by hindering the cleaning of the fields, have allowed this most formidable of weeds to ripen, shed its seed, and gain entire possession of the soil. This has happened especially in Yates County, where the soil is stiff and shaly. "It was unknown there, as elsewhere, thirty years ago; now hundreds of bushels of the seed are purchased at the Yates County oil-mill—and if it were worth 8s. instead of 1s. 6d. a bushel, these hundreds would be thousands." Thus one

evil leads to another; for the purchase of this seed at the oil-mills can only be for the purpose of adulteration. We beg the attention of our buyers of oilcake to the following remarks of the Professor's, who, in all his wanderings, has an eye to the interests of his countrymen at home:—

I have examined samples of American linseed-cake in which seeds were to be recognised which I could not name. They might, I then supposed, be those of the dodder, a parasite which infests the flax-plant in some localities; but they might also be other cheap seeds purposely mixed with the linseed. Those who are in the habit of buying cheap American cake may think this point deserving of their attention. As oil-cakes are chiefly bought by farmers, perhaps it is only a kind of retributive justice that a set of idle farmers in one country should thus be the means of punishing a less discerning set in another.

The next subject we select for notice is the cultivation of the *Apple* and *Peach* in North America.

The old apple-country of the United States—the home of the Newtown pippin, the Spitzemberg, and other highly-prized varieties—is on the Atlantic border, between Massachusetts Bay and the Delaware. But western New York and northern Ohio have now entered into earnest competition with these old districts, and threaten to bear away the palm. By its residents, the new apple-country is regarded as the finest fruit country in the world. The mollifying influence of Lake Ontario—which never freezes, as Lake Erie does—extends more or less over the whole level or slightly undulating region occupied by the lower portion of the Upper Silurian rocks, on which the rich soils of this part of the State rest, and from which they are generally formed. From Oswego, near the east end of Lake Ontario, to Niagara, beyond its western or upper extremity, this region forms a belt about forty miles wide by a hundred and fifty miles long; and over it the early frosts of autumn, which are so injurious to fruit-trees, are comparatively unfelt. The rich soils of this district produce larger and more beautiful fruit, though inferior, it is said, in that high flavour which distinguishes the Atlantic apples; and the profit of the cultivators is estimated, on the average, at from £20 to £30 an acre. In Wayne County, about the middle of this belt of land, the merchants of Palmyra, (a shipping village on the Erie Canal,) sent off 50,000 barrels of green or fresh, and 10,000 of dried apples in the same year, besides 1000 bushels of dried peaches. In Oneida County, part of four townships shipped on the canal, in 1848, as many as 18,000 barrels, at from 62½ to 100 cents per barrel. This is a very low price for good apples; but in New York the best apples sell for three or four, and in London for nine dollars a barrel.

Indeed so rapidly is the fruit-culture rising into importance in this region, and so great the number of persons now interested in it, that a Pomological Convention has recently been formed, for considering and investigating everything connected with the culture of the apple. Nearly two hundred recognised varieties of

apples, says Professor Johnston, are already cultivated in the States; and one important object which this Convention may usefully keep in view, is the classification and nomenclature of these different kinds. In the States, only the finest apples are sent to market—the waste or refuse being generally made into cider. But it is to be remembered that those varieties which are best for the table are unfit alone to make a palatable cider. The culture, growth, and selection of cider-apples, the proper mixture of varieties in the crushing-mill, &c., is a branch of husbandry requiring special knowledge, the acquisition and diffusion of which may be greatly promoted by a judiciously conducted association of growers.

In Normandy, (says Professor Johnston,) where the apple-culture for the manufacture of cider is an important source of revenue upon every farm, there are upwards of 5000 differently named varieties of the acid or bitter apple which yield the cider. These have all been collected and examined by Professor Girardin of Rouen, grafted on stocks, grown, figured, and analysed; and he informed me that the same apple was sometimes known by as many as eighteen different names in different parts of that country. I was struck, during a tour in Normandy two years ago, with the little skill and the antique and rude tools which appear to be there devoted to a branch of industry which is of much economical value to the farmers of the province. There are no hedgerows upon the farms, but the divisions of the fields are marked out by rows of apple-trees; and the crop of fruit—which there, as in so many other countries, is good only every second year—is expected to pay the whole rent of the land. In behalf of an industry of so much consequence to the rural population of a large province in France, to whole counties in England, and to large portions of other countries of Europe, and which is likely to be extensively prosecuted in America, it is time to ask whether the sciences of botany, meteorology, chemistry, and physiology cannot now be made to render them more direct economical aid than they have hitherto done.

In the United States also, as elsewhere, the apple-trees naturally yield a heavy crop only every second year. But Mr Pell—the owner of one of the finest orchards in America, on the river Hudson—has recently been investigating whether an *annual* crop might not be secured from his valuable Newtown pippin-trees, of which he has two thousand in full bearing. His experiments, we are told, were perfectly successful; only he had begun to apprehend that the life of his trees might be shortened by this course, and that he might have to replace them so many years sooner. Should this prove the result, it will still, probably, be found more profitable—as it is with the peach-orchards of New Jersey—to have a succession of new trees coming up to replace the old, than to continue to gather only one full crop in the two years. Mr Pell cultivates his orchard-grounds as if there were no trees upon them, and raises grain of every kind except rye—which crop, strange to say, he finds so injurious, that he believes three successive crops of it would destroy any orchard which is less than twenty years old. This is a physiological fact as yet incapable of being explained, but well deserving of scientific investigation.

It is well known that the quality of both soil and subsoil have a very material influence on the growth of fruit-trees — the

apple, the pear, the peach, and even the coffee tree, refusing to thrive or continue bearing in favourable climates, if the soil be unpropitious. This is not uncommon anywhere, but it is distinctly brought out in the case of the apple-tree at Miramichi, in New Brunswick, where the young trees die though the climate is most favourable; yet if a good deep soil be put under them, they will thrive well and bear good fruit. Another curious illustration of the connection of geology, even with this branch of rural industry is, that the nature of the rock over which the apple-trees grow, affects the flavour of the cider which is made from the fruit. Thus the cider of the chalk-soils in Normandy differs in flavour from that of sandy, and both from that of clay soils—the variety of fruit and the management being the same. Hence the *gout-de-terrain* spoken of by French connoisseurs is a correct expression for this recognisable difference. Doubtless, among the varied geological deposits of western New York, similar differences must likewise be observed, both in the fruit and in the cider made from it, which will give peculiar characters and recommendations to the productions of the several districts. Of course, climate must have its due, and its effects are striking enough. Thus, in New Brunswick, fruit of good quality may be raised, and the cultivation for home consumption carried on, with a profit; but the apples, though of a pleasant agreeable flavour, are in general small, and cannot compete with the large delicate apples of the Hudson River, of western New York, and of northern Ohio.

It is probable, I think, (says our author,) that the great heat of the sun is in reality a chief cause of the smallness of the fruit, hastening the ripening process before the apple has had time to swell. Its scorching effect was seen upon the fallen fruit, which was dried and altered, as if by artificial heat, on the side which had been exposed to its rays. The *ten o'clock* sun has the effect also of scorching the young trees, burning a stripe all the way down the stem, and finally killing them. The preventive is to wind a straw rope round the stem, and to let all the branches grow till it has got a rough bark. It is an interesting fact, that part of a stem thus protected will thicken faster than the uncovered portion, and, when the straw is detached, will be sensibly of a greater girth.

The celebrated apple-toddy of Maryland, Mr Johnston informs us, is made as follows:—"Take a red-streak apple, roast it before a slow fire on a china plate, put it into a half-pint tumbler, mash it well, add one wine-glassful of good cognac, and let it stand twelve hours. Add then two wine-glasses of water, dust it over with nutmeg, put in a spoonful of white sugar—stir up well, and drink." This is genuine apple-toddy, taken as a water-drink—mint-juleps taking its place in summer. Among these jovial Middle States men, a stranger has a chance of living according to his humour, which the determined temperance-upholding people of the north-eastern States scarcely permit.

One of the greatest enemies of the apple-orchard belongs to a kind of tree-destroyers comparatively unknown in our own country. These are the *borers*—a class of insects abundant both in

numbers and species, and very characteristic of Northern America; for the habit of boring is peculiarly adapted to a region where the severity of the winter's frost destroys all insects which have not provided themselves with an adequate shelter. The apple-borer is the larva of a beetle called *Superda bivittata*, which attains the length of a half to three-fourths of an inch. In June and July this beetle lays its eggs upon the bark of the tree, near the root, during the night: the white fleshy grub hatched from these eggs, cuts a passage for itself through the bark, and bores into the body of the wood, casting its borings behind. It remains here two or three years in the larva state—during which time it ascends the trunk probably ten or twelve inches, or even further, and is found at the end of its wanderings covered only by the bark. Here it is transformed; and, casting off its proper skin in the month of June, it comes forth a perfect beetle, to deposit its eggs as before, and give birth to a new generation of pests. "I saw the stems of young trees cut down in Mr French's orchard as useless," says Professor Johnston, "which, though scarcely thicker than my arm, were absolutely riddled with holes, ascending from four to eight inches, chiefly through the exterior inch of the wood." The cure is to spread lime (half a peck, air-slaked) round the bottom of the stem during the summer and autumn, with the view of preventing the deposition of the eggs, and to lay bare the foot of the stem, and follow into their holes, with a crooked wire, those larvæ which have already secured an entrance.

The pear and peach trees, also, are each attacked by their own borers, which are species of *Egeria*, a genus frequenting the stems of our European currant-bush. The grub of the peach-borer (*E. exitiosa*) grows to the size of three-quarters of an inch in length, forms a cocoon, passes the winter in the tree, and emerges in a winged form in the month of June. But these pests do not confine their ravages to the trees of the orchard. The beautiful sugar-maple is often destroyed by a coleopterous borer called *Clytus speciosus*. The magnificent American elm is subject to a similar visitation; and scarcely a tree of any value has not, in that country, its own enemy with a boring propensity. Even a squash is attacked by a borer (*Egeria cucurbitæ*,) which frequently —as was the case with Jonah's gourd—causes the plant to die suddenly down to the root.

For those who are curious in such recipes, we may state that a Mr Heustie of New Brunswick kills caterpillars on his apple-trees by boring a hole halfway through the stem, filling with sulphur, and plugging it with wood. The caterpillars disappear, he says, in twenty-four hours. For lice and other small vermin, he opens a piece of the bark, introduces a few drops of turpentine, and then ties it up again. Both remedies he pronounces to be infallible.

New Jersey, Delaware, and Maryland are famed for their orchards, and New Jersey especially for its immense produce of

peaches. Orchards of ten to twenty thousand peach-trees are not uncommon in this State; and each tree yields, when in bearing, an average produce of a bushel of perfect fruit. This is sent in vast quantities to the markets of New York and Philadelphia, where the price varies from fifty cents (2s. 2d.) to four dollars (17s. 6d.) a bushel—the average retail price being about 6s. 6d. a bushel. The soils of the peach-producing States vary very much in quality, and the mode of culture is consequently very different in different parts of the country. On the light soils, Indian corn, rye, or some other suitable crop, is sown between the rows of trees —which are planted sixteen to twenty-five feet apart—during the first season only after the trees are planted. The surface is then left at rest, is enriched by top-dressings, and is undisturbed by the plough. This treatment is the most proper, under the circumstances: for the soil is poor and thin; the roots run along the surface in search of food; and the plough, if put in, would injure them, and would retard the growth of the tree. On these soils the tree is very short-lived, and continues in profitable bearing only about three years. The extensive peach-grower, therefore, has always a succession of young trees coming forward. They bear the third year; and if they produce two good crops afterwards, they repay the investment. On the richer, deeper, and stronger soils, on the contrary, the interspaces are ploughed and cropped year after year. The roots of the trees descend beyond the reach of the ploughshare; the land is kept open, mellow, and clean, by the culture; the tree, with proper care, yields crops of marketable fruit for twenty successive years, and is more luxuriant than when the sod is unbroken.

For a hundred years the peach flourished without care, and full of health, from the mouth of the Chesapeake to the Connecticut River, and produced an apparently exhaustless abundance of fruit. But about 1800, attention was drawn, around Philadelphia, to the sudden decay and death of the orchards without known cause. The fatality spread through Delaware into New Jersey, where in 1814 many of the orchards were entirely destroyed. Some years later, it appeared on the banks of the Hudson, thence spread north into Connecticut, and is now slowly but surely extending along the rich soils of western New York, towards the great centre of the peach cultivation of the States, on the Ohio and Mississippi rivers.

This disease is now called the *yellows*,—is peculiar to the peach-tree, and, it is said, to America. As the name implies, its character is to cause the tree to produce slender wiry shoots, with small, narrow, yellow leaves,—to ripen its fruit two or four weeks earlier than usual,—to yield fruit diminishing in size, and becoming purplish, spotted, and redder in the flesh every year,—and to die altogether in from one to four years.

For thirty years this disease has killed off the trees by thousands, yet cause and cure for it are alike unknown. It is believed to be contagious, and is certainly propagated by budding or grafting from a diseased tree, and affects the stock, whether peach, apple, plum, or apricot. Trees which exhibit it must be cut down,

the land unorcharded, and tilled for some years,—and then healthy young trees, if they can be got, planted in their stead. Although much mystery hangs over the nature of this disease, certain facts in its history are interesting and instructive, not only to the fruit-growing, but to the grain-raising farmer also. In the peach-orchards, the professor informs us, as on the new wheat-lands, a thoughtless exhausting culture was carried on. As if the soil would never tire of yielding, the unpruned trees were encouraged to yield their annual loads of most abundant fruit; no manure was given; and wherever it was possible, a constant cropping of the interspaces hastened the exhaustion of the overtasked land. As a natural result, the trees gradually diminished in vigour, and an enfeebled progeny arose, which disease, in one form or other, was sure to attack. "There is a great similarity," concludes the Professor, "between the progress of the wheat-failure, (in America,) caused by the attacks of the midge, and that of the peach-orchards above described. The injury in both cases is first done to the soil; and a sure return to a better state of things can only be made by renovating the soil itself, and by a more prudent and skilful subsequent cultivation."

The *grape*, also, is cultivated in the States, and promises by-and-by to rise into considerable importance. There are several native varieties,—one of which, called the Cape grape, yields a rough, red, acid wine, resembling (and, when doctored with brandy, equal to) the teneriffe. Foreign grapes also thrive well with proper culture, and with proper shelter and warmth; but they do not become acclimatised. The native varieties alone seem fitted to be grown extensively and profitably for the manufacture of wine. The following remarks of Professor Johnston (with which we conclude our notices of his instructive work) will give our readers a tolerable idea of the present state of the grape-culture in the States of the Union:—

At dinner, Mr French treated me to a bottle of American wine from the vineyard of Mr Longworth of Cincinnati, on the Ohio, probably the best-known among Transatlantic grape-growers. This was prepared from the Catawba grape, a native variety, and was a species of dry hock, with a peculiar bouquet and flavour. This grape, according to Mr Longworth, produces, in the hands of a skilful *wine-cooper*, hock of all varieties equal to the imported, and champagne of the very first quality. Mr Longworth has himself twenty acres in vineyard, under the care of Germans and Swiss; and the large German population on the Ohio are every year planting new vineyards, so that he states his belief that this river, "in the course of the next century, will be as celebrated for its wine as the Rhine." The best crop he has seen was on the vineyard of a neighbour, which yielded from the Catawba grape 900 gallons an acre. A fourteenth of an acre, from the best part of one of his own vineyards, yielded at the rate of 1470 gallons an acre. The wine meets a ready sale among the German population, at prices varying from 75 cents to 1½ dollars a gallon.

Precautions against the Adulteration of Guano.—By J. Towers. The abominable frauds practised by dealers, in one of the best fertilisers that ever was recommended to the practical farmer, have attracted the notice of several eminent agricultural chemists.

A case of great importance has lately been successfully exposed in one of the law courts of the metropolis, to the great advantage, we may hope, of the agricultural reader. The complicated nature of all true guanos must prove a bar to an attempt, in the way of chemical investigation, by any one who is not versed in the refined processes of the laboratory. Of this fact the farmer may convince himself by a careful perusal of the two articles by Dr Thomas Anderson, the first of which commences at p. 501 of the *Transactions of the Highland and Agricultural Society*, No. 31 of this Journal; the second at p. 44, *Idem*, No. 34. .

Professor Way, consulting chemist of the Royal Agricultural Society of England, has also taken up the same subject at some length, in order to show the real money value of several samples. They who possess, also, the Society's journal, can derive much profit by an attentive comparison of both those articles. Dr Anderson, according to promise, (p. 501,) places on record the composition of several sorts of guano, of which several specimens were analysed in his own laboratory: of the tabulated results I shall thankfully avail myself, in order to justify the statements that my own protracted experiments enable me to offer to those parties who are desirous to avail themselves of a few simple directions, which may guide them in the selection of any quantity of guano that they desire to purchase. It has long been notorious that the chief article employed for the adulteration is a soft sandy earth, of a colour resembling that of dry pure guano. The *Gardeners' Chronicle* strenuously laboured to expose this fraud; and Dr Anderson further instructs us that the wilful adulteration is almost entirely confined to the *Peruvian* guano. He adds, "From being much more valuable, and in greater demand, than most other varieties, there is greater inducement to the fraudulent dealer to tamper with it. I believe the adulterations practised are two—with sand, or, more correctly, a sort of brownish yellow loam, not differing much in colour from the guano itself, and with gypsum. Gypsum, however," Dr Anderson adds, "is now very rare as an adulteration; and I have not myself met with it; nor have I seen any case in which ground coprolites have been employed, although it is asserted that they are sometimes used. The use of coprolites is a sort of refinement in the art of adulteration; and though less injurious than sand alone, any quantity of them mixed with Peruvian guano greatly adulterates it."

Here a word may be spoken in due season with respect to coprolites. If the term do indeed express the precise meaning of the Greek words from which it is derived—namely, *dung* converted to *stone*—then, indeed, we should hesitate ere we attach credence to the asserted virtues of a mere *petrifaction*.

A regular quantitative analysis of a substance so comprehensive as guano is not to be thought of by the uninitiated; but I hope to prove that any farmer who has a leaning towards chemical

investigation, and is resolved not to be made the victim of a fraud so expensive as is an adulterated article—for which he pays perhaps £7 per ton—may adopt a few easy processes by which a separation of the leading components of the sample to be investigated may be effected with very satisfactory results. I now propose to abstain entirely from the didactic language of an instructor, and to offer the recital of a few plain facts only. I happened to call upon a neighbouring farmer, who is one among the few about Croydon who are inclined to try the effects of guano on their land for certain crops. He had just made a bargain for about a ton, at the price of £10, and wished me to give an opinion of its worth. The guano had been delivered, and from one of the bags he took a few ounces as a sample, observing that he was under agreement to pay for the lot on the following day. I saw at once that there was rather too much moisture in it, and therefore weighed 100 grains, and placed them on the hob of a grate about so hot as barely to discolour the white paper which contained the powder. After a time, when that effect had been produced, I found the loss of weight to be about 10 grains, and this is under the average of the eight samples tabulated by Dr Anderson under the head "*water*," p. 503. No time was given to ascertain by due experiment the quantity of actual ammonia in combination as a *base* with the several acids that are in general present in good guano; but I treated a few grains with solution of caustic potash, and from the very pungent ammoniacal gas so produced for a considerable time, it appeared that the quantity of ammonia in the sample must be in fair proportion. Trials were then made to discover the soluble and insoluble constituents in a given weight. Here the defects were partially revealed, for only 35 grains were dissolved by rain water from 100 grains of dried and powdered guano, leaving 65 grains of insoluble matters, which, presuming the presence of at least 25 grains of bone phosphate, with abundance of urate of ammonia, and undefined organic remains, say to the extent of 25 grains more, still leave 10 grains not accounted for. Therefore, in the hurried answer I had to send to my friend, within twelve hours after he had given me the sample, I estimated the value of the ton at a good deal less than he had covenanted to pay for it.

According to Dr Anderson's tables, and those of Dr Ure, from 1½ to 2 per cent of sand (silica) is a full proportion of those inert substances which ought to exist in genuine Peruvian and Bolivian guanos; and, therefore, any great excess must be referred to adulteration.

Some time since I had occasion to prosecute a series of experiments with several kinds of guano, and therefore, without possessing either opportunity or apparatus to conduct all the processes which are effected in the laboratories of chemical institutions, I rendered myself competent to apply the various re-agents

which are used to detect their valuable constituents. I procured, from time to time, samples which I had reason to believe were free from home adulteration, but never found any two that yielded precisely corresponding results. After the announcement by Messrs Thomson and Way of the power of good aluminous loams to absorb and fix a certain quantity of manure—a discovery, by the by, which, in fact, amounts only to an explication of natural processes long *observed*, but never duly examined or studied—I proved, by several experiments, that soils of rather feeble pretensions to permanently sound qualities possessed the power to absorb and fix the colouring, organic, and principal saline elements of a strong watery solution of very good guano; and also to produce the filtration and discharge of much cretaceous *hard* water. It then occurred to me to adopt a process by which I might detect, and enable others to ascertain with tolerable accuracy, the proportions of ammonia, &c., which a sample of guano might comprise. I therefore recurred to the one (call it No. 1) given me by the party alluded to, and then followed up the inquiry with two other samples obtained in places very remote.

In the first place, by reducing a given weight of each to powder, and drying it in a regular strong heat, (that of a hot-water bath is the best,) the quantity of water held by the guano would be determined. Thus, in 100 grains of the first sample I found the percentage of loss 10.15. In another, obtained from Mr Purser of Bridge Street, Blackfriars, (No. 2,) I found 12 per cent. A third sample, procured by a druggist in Surrey, lost 9½ grains in the 100, or 9.5 per cent. We have seen that sample No. 1 (100 grains) contained only 35 grains of salts dissolvable in rain water, leaving 65 grains of sediment when thoroughly dried. No. 2 lost 50 grains, and left 50 grains by a similar treatment; but, in this instance, the guano was not previously dried.

In order to estimate the quantity of ammonia already existing in any given weight, 50 grains of No. 1, and 30 grains of air-slaked lime, were triturated in a wedgwood mortar, and immediately transferred, without farther drying, to a small saucer or *capsule*. The odour of ammonia became sensible to a trifling extent. Sufficient hot water was then added to reduce the mixture to a paste, and the vessel was placed on the hot stock of a grate—stirring so long as any moisture remained: the 80 grains were reduced to 70, showing a loss of 10 grains, which was ascribed to the extrication of ammoniacal gas—say 5 grains; and to the evaporation of moisture from the guano and lime—say 5 grains. The experiment being repeated with exactly the same results, led to a more correct and satisfactory operation. The lime and powdered guano of No. 3 were dried in separate papers, placed in precisely the same situation, at the same heat, and 26 grains of the lime, and 50 of the guano, were mixed and triturated, were transferred to a small balanced saucer, weighed, moistened with about a tea-spoonful of rain-water, and stirred with a pointed

quill. Ammoniacal gas was yielded, but in much greater volume when placed on a hot grate till dry. It was then again wetted to a paste with boiling water, kept hot, stirred repeatedly, and left in heat till dust dry, when the smell of ammonia was entirely lost. The weight was now reduced to 59½ grains. This loss—being 6½ grains—if assigned to ammonia only, would indicate 13 grains in the 100—that is, of ammonia actually existing as a base to some or all of those acids which are found in the soluble ingredients of sound and pure guano. I am prepared to admit that the process I employed must ever be regarded as crude, when compared with that of distillation, either with hot lime or caustic potash, as described by Dr Ure in the Royal Agricultural Society's Journal, vol. v., p. 295, and by Mr Way in a more recent volume of the same work. It is true also that some correction should be admitted for the water combined with lime in the process of slaking, which amounts to about one-fourth of the product, as a *hydrate*, when the shell lime is fresh from the kiln. But yet if, by repeated experiments with several kinds of guano, certain definite quantities are left, and corresponding loss of weight determined, a comparative standard of the proportion of actual ammonia will be attained—one sufficient, at least, to guide the judgment of a discerning practical agriculturist.

Dr Anderson agrees with Mr Way, when he observes (p. 506) that "practically there are only two constituents which require to be considered in the estimate of the commercial value of guano and the phosphates." This is true, and the reader would be wise to reperuse all that is printed thereon in pp. 506-7. As to the *phosphates*, though it may be admitted that some phosphoric acid is traceable in the salts of many guanos, soluble in water, yet the phosphate, in bulk, which is chiefly available in turnip-culture, exists in the *bone earth* that remains with other insoluble matters after water has taken up all that it can dissolve.

The sample given by Dr Anderson (No. 2, p. 504) corresponds pretty well with my No. 1, where we observe 23.50 of phosphate, 13.22 of sand, (12 of which are extraneous,) and 10.04 of ammonia.

In conclusion, I copy the following directions from an article on *Analysis*:—1. To determine the *total organic matter* in a guano, "100 grains of the dry substance are burned in a crucible, (a small platina saucer is best.) The ammoniacal salts and organic matter are thus driven off, and the residue, which consists of phosphate of lime, &c. is weighed." To estimate the phosphates—"The residue of combustion is treated with hydrochloric acid, (spirit of salt,) with heat, by which means the phosphates are dissolved: the insoluble residue is principally sand. It is collected on a filter, dried, and weighed. To the filtered liquid ammonia is added, and the precipitated phosphates are collected, dried, burned, and weighed: their weight pretty nearly denotes that of the earthy phosphates in the guano." These

observations are substantially correct, as I have repeatedly proved. The hydrochloric acid ought to be diluted with twice its quantity of water, and the vessel used should be a glass or stoneware saucer. The phosphates precipitated comprise a small portion of the ammonio-phosphate of magnesia, but this is of minor consequence.

Agricultural Statistics of Europe.—At a time when every question bearing upon the agricultural capabilities of the different European States is so much canvassed, the following tables, which are chiefly compiled from a French work on Political Economy and Statistics for 1851, will not be uninteresting :—

I. Extent of Territory in Hectares. 1 Hectare = 2½ acres nearly.

States.	Arable.	Meadow.	Forests.	Other Surfaces.	Total.
France,	27,654,659	4,198,198	8,804,550	22,111,293	52,768,610
Great Britain,	7,655,396	10,944,792	..	..	30,956,772
Belgium,	1,544,950	219,080	558,774	629,445	2,962,249
Prussia,	12,314,663	3,637,400	6,674,500	6,246,200	28,269,763
Bavaria,	3,433,210	949,334	2,447,742	959,472	7,789,758
Baden,	478,746	146,330	473,807	418,530	1,527,463
Switzerland,	606,000	225,000	600,000	2,650,112	4,081,112
Sardinian States,	1,142,720	200,000	1,200,000	3,000,000	7,693,300
Spain,	24,840,000	6,750,000	1,500,000	15,719,794	48,809,794
Netherlands,	662,000	1,092,090	106,365	1,277,818	3,265,521
Schleswig-Holstein,	1,241,600	142,100	170,520	460,404	1,909,824
Sweden and Norway,	1,536,800	1,926,558	35,662,137	5,687,315	85,445,978
Russia,	61,625,000	6,125,000	169,000,000	192,750,000	438,108,931
Mecklenburg,	727,162	145,433	204,521	485,959	1,563,075
Hanover,	1,895,597	208,692	728,837	1,908,563	4,741,689
Saxony,	862,157	180,242	343,049	71,534	1,456,984
Wurtemberg,	862,286	232,726	566,839	292,624	1,953,875
Hesse,	407,448	123,352	270,353	32,391	840,544
Hesse Grand Duchy,	350,012	120,000	378,720	333,134	1,182,466
Other German States,	992,674	212,172	667,535	1,765,379	3,637,760
Austria,	22,286,286	6,676,270	20,321,910	16,948,198	66,232,664
Tuscany,	730,487	663,244	564,974	1,272,120	3,230,825
States of the Church,	1,864,646	127,249	772,417	1,374,089	4,148,395
Two Sicilies,	3,846,000	1,625,000	1,080,000	4,354,154	11,495,154
Other Italian States,	690,000	165,000	200,000	235,268	1,290,268
Portugal,	1,845,000	90,000	500,000	5,764,000	8,199,000
Turkey,	22,000,000	3,000,000	8,000,000	36,401,000	69,401,000
Greece,	..	..	1,120,000	2,588,649	7,618,469
Denmark,	1,241,600	450,200	113,680	2,025,000	3,831,240

II. Wheat and Rye produced in the different countries of Europe, in *hectolitres*. One *hectolitre* = 2.8 bushels.

States.	Wheat.	Rye.
France,	80,143,733	51,835,466
Great Britain,	35,473,000	1,500,000
Belgium,	4,091,916	5,433,606
Prussia,	6,684,000	45,876,000
Bavaria,	2,770,607	6,418,514
Baden,	2,570,300	510,600
Switzerland,	1,000,000	1,200,000
Sardinian States,	3,800,000	1,000,000
Spain,	—	—
Netherlands,	1,999,902	1,597,906
Luxemburg,	220,000	350,000
Denmark,	840,000	4,480,000
Schleswig-Holstein,	886,200	1,692,600
Sweden and Norway,	342,665	5,947,820
Russia,	19,000,000	149,750,000

STATES.	Wheat.	Rye.
Mecklenburg,	622,460	1.200,000
Hanover,	1,320,000	2,000,000
Saxony,	1,100,000	2,337,500
Wurtemberg,	6,154,821	540,558
Hesse,	1,915,000	2,200,000
Other German States,	1,250,000	3,500,000
Austria,	29,100,000	38,710,524
Tuscany,	1,500,000	500,000
States of the Church,	8,000,000	—
Two Sicilies,	19,997,700	—
Other Italian States,	3,500,000	—
Portugal,	3,501,000	2,528,500
Turkey,	—	—
Greece,	275,000	—

It is unnecessary to say, that in some countries maize, and in others barley, oats, buckwheat, chestnuts, potatoes, and even rice, form important articles of consumption. But it would have filled up much space, without conveying a proportionate amount of information, to have attempted to include these articles in the above table.

III. A TABLE indicating those countries where there is an abundance or an insufficiency of wheat. The wheat is calculated as flour, by deducting one-fifth from the weight of the grain. The weight is given in *metrical quintals*. 1 quintal = 220 lb.

STATES.	EXCESS OF		EXCESS OF	
	Imports before 1846.	Exports before 1846.	Imports in 1846-7.	Exports in 1846-7.
	Average of several Years.			
France,	585,123	—	4,927,091	—
Great Britain,	2,890,538	—	5,972,279	—
Belgium,	498,432	—	1,619,866	—
Zollverein,	—	1,942,400	164,516	—
Switzerland,	36,000	—	98,400	—
Sardinian States,	—	140,000	—	120,000
Spain,	—	30,000	400,000	—
Netherlands,	88,000	—	1,326,000	—
Denmark,	—	548,500	—	416,480
Sweden and Norway,	328,000	—	—	—
Germany, (*exclusive of the Zollverein*,)	—	45,000	—	—
Russia,	—	3,560,000	—	5,250,000
Austria,	—	278,800	—	164,813
Two Sicilies,	—	100,000	—	250,000
Tuscany,	1,128,000	—	960,000	—
States of the Church,	—	5,000	—	15,000
Portugal,	60,000	—	8,000	—
Greece,	3,000	—	—	—
Turkey,	—	460,000	—	—
Egypt,	—	550,000	—	755,000
Morocco, Tunis,	—	30,000	—	—
United States,	—	824,000	—	1,650,000
Other American Countries,	500,000	150,000	—	—

IV. Live Stock.

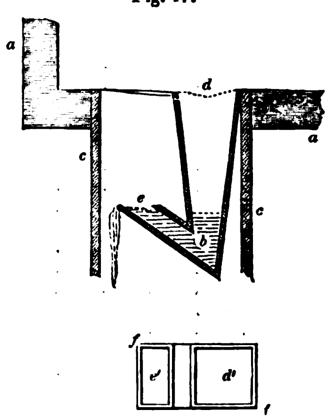
States.	Horses.	Cattle.	Sheep.	Pigs.	Goats.	Asses and Mules.
France,	2,818,196	9,936,536	32,151,430	4,910,720	964,300	787,330
Great Britain,	1,500,000	6,865,000	32,000,000	4,000,000	210,000	—
Belgium,	250,000	912,740	730,649	421,208	85,000	—
Prussia,	1,570,000	5,042,000	16,260,000	2,116,000	395,000	—
Bavaria,	349,690	2,625,294	1,899,898	842,851	107,236	—
Baden,	317,744	492,153	188,707	481,000	—	—
Switzerland,	145,500	950,000	550,000	280,000	350,000	—
Sardinia,	220,000	950,000	1,750,000	370,000	575,000	—
Spain,	300,000	2,000,000	18,000,000	2,000,000	4,000,000	900,000
Netherlands,	220,778	1,061,116	615,000	500,000	70,000	—
Denmark,	325,019	834,173	1,164,544	157,599	—	—
Schleswig-Holstein,	125,393	529,803	323,164	111,631	—	—
Sweden and Norway,	501,378	2,474,615	2,854,180	892,438	177,470	—
Russia,	13,660,000	22,120,000	39,000,000	6,300,000	1,550,000	—
Mecklenburg,	120,000	268,000	1,188,000	140,000	—	—
Hanover,	257,300	794,000	1,631,000	201,000	8,000	—
Saxony,	86,582	554,910	583,134	120,931	64,975	542
Wurtemberg,	106,035	1,186,782	676,659	167,219	27,947	—
Hesse (*Grand Duchy*,)	42,458	263,636	218,257	167,178	39,646	—
Hesse (*Electoral*,)	51,000	225,000	562,000	140,000	51,000	—
Other German States,	184,694	1,004,699	1,952,314	467,731	81,420	—
Empire of Austria,	2,827,131	11,471,623	33,767,000	7,000,000	443,000	92,908
Tuscany,	150,000	210,000	600,000	80,000	90,000	—
States of the Church,	64,500	171,800	1,256,000	246,200	123,100	5,500
Two Sicilies,	150,000	400,000	4,000,000	2,000,000	1,000,000	210,000
Other Italian States,	90,700	250,000	150,000	160,000	60,000	—
Portugal,	317,000	740,000	4,980,000	728,000	1,400,000	—
Turkey,	1,950,000	8,200,000	14,300,000	300,000	1,500,000	—
Greece,	120,000	900,000	2,500,000	40,000	300,000	—

AGRICULTURAL ARCHITECTURE AND ENGINEERING.—No. II.

By R. S. Burn, Author of *Practical Ventilation.*

In our last paper we gave various illustrations explanatory of the method of laying cottage floors in a cheap and expeditious manner, placing of drains, liquid-manure tanks, traps for drains and sinks. We now, as a conclusion to the last department, give a sketch of an extremely simple form of trap. Let *a a* represent part of the sink; *c c* the pipe leading to the drain; *d e*, the trap, of which *f f* is a plan; *d d'* being the end through which the liquid passes from the sink, and *e e'* that through which it leaves to the drain. An inspection of the figure will show at once the way in which the trap is constructed. A perforated cover *d* being put at the end *d*, this cover may be made to hinge at one side: by opening this, any solid matter collected at the angular part of the trap may be removed. An examination of the forms of traps we

Fig. 17.



have given will best convey the principle of their construction. In all of them, the exit aperture is made at such a level that the liquid always remains to cover that part of the trap round which the foul air must necessarily go, before ascending the trap; this ascent of the foul air is thus prevented so long as the water is at the proper level. Thus the angular point *b* in fig. 17 being surrounded with water, the air entering by *e* cannot possibly pass out at *d*. In process of time, the solid matter is apt to deposit itself in the bottom part of the trap, and by this means to render it ineffective. This deposit should from time to time be removed; and, to facilitate the operation, the perforated covers should in all cases be movable. In traps where no great quantity of solid matter is held in the water passing through the trap, an occasional mass of water sent down will effectually prevent any undue deposit. The distinctive feature of traps for all such purposes as drains and sinks being kept in mind, the modifications in construction and arrangement may be very numerous. The last one we have figured may be made for a few pence.

The portion of our paper to the consideration of which the sequence of the subjects—according to our arrangement—leads us, is the very important one of the supply of water for the various wants of household purposes. Essential as a supply of *good* water is to the maintenance of health and comfort, it is, notwithstanding, met with a degree of apathy on the part of proprietors of houses most strikingly apparent. So long as a comparatively liberal supply is obtained, little heed is taken of other considerations; if quantity is deemed essential, quality is unfortunately ignored: but even as regards the first, too many proprietors are unfortunately indifferent. Alas! for the condition of many of the labouring classes, when water in anything like wholesome purity is wholly unattainable; when time, which to them is valuable, is to be expended in carrying water from a distance to supply the necessary wants of cooking purposes—those of cleanliness being too often laid aside! We might here cite numerous instances of the bad effects of a deficient supply of water both on the moral and physical condition of our labouring population in large towns; but this is unnecessary, it being chiefly with the question of its application in the rural districts that we have to do. And there the scenes of Arcadian bliss and happiness, of which a novelist might write, or a Cockney dream, are but seldom met with: the battle of life occupies with too stern an interest the minds of all engaged in rural occupations to allow them to think much of these pleasant phantasms of the brain. Not that the contemplation of Utopian schemes of country happiness are calculated to do much good—nevertheless they might have a reflex influence in directing attention to the realisation of more comprehensive schemes of making their labourers comfortable, and more independent of those adjuncts to household inconveniences, which either end in the pauper's bed or the workhouse grave.

With regard to the supply of water to houses in rural districts, how easy is it, in a day's walk, to find instances of the sad neglect in personal and household cleanliness induced by the absence of a good supply. In many villages and clusters of cottages the want of water is painfully apparent. How often have we felt ashamed of the system, which made it a matter of imperative consequence for the poor cottar or cottar's wife to walk a considerable distance before a scanty supply could be obtained even for the commonest purposes of civilised life. Verily the sight of a female, after a hard day's work in the house or in the fields, toiling through miry or dusty roads, painfully reminds us of the toils of savage life in the ruined cities of Ancient Mexico, where water, kind nature's precious gift, is secured only by the severest bodily toil. We hold it as a matter of easy proof, that it is the interest—we mean the pecuniary interest, not that induced by the common principles of humanity—of all landlords who are careful to make the most of the "bone, flesh, and sinew" under them, to give to each habitation a liberal and easily-obtained supply of pure and good water. We do not wish to urge this, without considering the all-important question, How much will it cost? We hope to be able to show that the expense of doing so is so slight as never to afford a reasonable excuse for delaying to carry out the plan; but, at the same time, so important do we deem the matter, that, as a slight inducement for proprietors to consider it before coming to, it may be, an adverse decision, we give the following as the opinion of one who is entitled to consideration:—

> Supplies of water obtained from wells (or springs) by the labour of fetching and carrying it in buckets or vessels, do not answer the purpose of regular supplies of water brought into the house without much labour, and kept ready in cisterns for the various purposes of cleanliness. The interposition of the labour of going out and bringing home water from a distance acts as *an obstacle to the formation of better habits*; and I deem it an important principle to be borne in mind, that, in the actual condition of the lower classes, convenience of this description must precede and form the habits. It is in vain to expect, of the great majority of them, that the disposition, still less the habits, will precede or anticipate and create the inconveniences. . . . It is a serious inconvenience, as well as discomfort to them, to have to fetch water at a distance out of doors from the pump, or the river (or spring,) on every occasion that may be wanted, whether it may be in cold, in rain, or in snow. The minor comforts of cleanliness are of course foregone, to avoid the immediate and greater discomforts of having to fetch the water.

Again, the evidence of the inquiries made into the state of the health of the labouring population goes to prove that a large proportion of the comparatively healthy districts may be attributed to good supplies of water being provided; and it is remarkable that, where great mortality exists, the almost absolute want of water is observable. Again, drainage cannot be efficiently carried out without a good supply of water—in fact, it is the *only* vehicle by which the drainage can be carried off easily and cheaply; and it is notorious that, where defective drainage exists, there also exists disease in its most loathsome form, and death plays an important part. Knowing these facts—and the mere knowledge

of them should act as an overpowering influence for good—it would be but a mere idle waste of time to follow out the argument, and show how defective supplies of water must necessarily involve defective health and strength; and where these are deficient in our labouring population, they must be supplied, or the loss sustained; and what this loss is, let those tell who feel heavily pauper taxes. But it may be said that it is easy to see how towns can be supplied with water, when all the powerful machinery fitted and brought into action by powerful companies is, or may be, employed; but how can rural villages and hamlets have this great advantage? We would not advocate such a system—not that it is impracticable, but, as society is at present constituted, it may be deemed rather Utopian. But it behoves every one interested to consider whether, in showing the impracticability of one plan, it is wisdom to decide at once that there is no other available. It is an easy matter to show that there is. On the principle of taking thankful advantage of the gifts of nature, we would advocate the importance of making arrangements in every house—no matter how low it rates in the rank of buildings—to collect and save for use those heaven-sent supplies which alike are rained upon "the just and unjust." As we have elsewhere said, "It is a notorious fact that, while the inhabitants of large and populous towns are maintaining lustily that they are woefully stinted in their supply of water, they allow gallons upon gallons of valuable soft *rain* water to go to waste, without a single effort to retain a drop; while the inhabitants of other towns, "wiser in their day and generation," use all available means to catch and retain the "descending showers." Now, if this waste is to be deprecated while taking place in towns, it is no less to be so in villages and rural cottages.

Before proceeding further with the practical hints we have to offer on the subject, a few remarks on the various sources of supply of this essential fluid may be allowed. We may class the sources to be obtained in country districts as *rain*, *spring*, and *burn* or *river*. *Rain water*, when collected on pure surfaces, and descending through a comparatively pure atmosphere, is entitled to be considered the purest we can obtain, and, from its solvent powers, is peculiarly valuable for household and detergent purposes. Rain water, in truth, in its purest state, is nearly equal to distilled water. One great objection to rain water as a *constant* source of supply for household purposes is, the decided affinity it possesses for organic impurities derived from animal and vegetable substances, everywhere predominant within the range of man's dwellings: hence the quickness with which rain water becomes tainted. This taint, fortunately, can be nearly altogether removed by filtering, and by keeping it from contact with the floating substances in the air. Another source of impurity is the atmosphere through which the rain falls. The substances which there

exist are taken up by the rain, and consequently exercise an influence in tainting it, more or less decided according to circumstances. Thus in manufacturing towns the atmosphere immediately above them is strongly impregnated with soot, and the gases emanating from a thousand fertile sources. The rain water descending in such places, therefore, is generally very impure, and rendered ultimately more so, by passing over surfaces in which the more solid impurities abound in large quantities. The conditions necessary to be observed in order to obtain an available supply of rain water, useful as well for *drinking* as for cooking and detergent purposes, are these—first, The arrangement of a tank or cistern large enough to contain a quantity at one time, so that the over-abundance obtained in rainy weather may compensate for the deficiency occasioned by dry;—secondly, The keeping of the cistern in a cool and *shaded* place, well covered, so as to exclude the air and the filthy impurities suspended in the atmosphere—(light and air have been found powerfully predisposing agents to the propagation of animal and vegetable impurities;)—thirdly, The agitation of the water, from time to time, to retard the formation of the living products of organic impurities;—fourthly, The proper and careful filtration of the water before use. This last is an important point, and must be carefully attended to. We shall hereafter return to its consideration.

The next source of supply is *spring water;* and by this we include the supplies obtained from springs which issue at once from the surface of the earth, and those derived from springs intercepted in their course by the sinking of wells, &c. Spring water is that obtained from the clouds, falling on the surface and draining or forcing its way through the various kinds of soil, until meeting one through which it cannot pass—as clay, or hard rock having no fissures—it forces itself up through a convenient opening in the earth, and is obtainable there by simple methods. As in various sections of country the springs or streams of water percolate the soil at various depths, by sinking wells these may be intercepted; and, from a tendency to find its level, the water will rise; and if the level of its source is higher than the ground, it may be collected at the surface. In our future remarks we will return to the subject of well-sinking. In general, spring water is free from organic impurities, and this from its slow and gradual filtration through beds of suitable soil. So powerful an agent is this for the freeing of water from impurities that it has been ascertained, by allowing impure water, even that tainted by sewage liquid, or by passing through graveyards, to undergo this natural filtration, the water is restored to comparative purity. The impurities of spring water are chiefly mineral, these being derived from the strata through which the water passes in its course to an outlet. In country residences the solid impurities in spring water are chiefly derivable from muddy particles, occa-

sioned by careless lifting of the water from its outlet bed. We have often seen the pure water of a roadside spring so disturbed by wanton carelessness as to leave nothing behind but a discoloured and filthy-looking liquid, which time and gentle subsidence could alone remove. If the spring should issue from the side of a bank at some distance from the ground, a pipe or drain-tile should be fitted to it, by which the water may run into the vessel without coming in contact with the soil at all. But in cases where the spring issues from the ground at or near its level, so that a very shallow depth of water is obtained before it finally runs away, it is almost impossible for a supply to be obtained by the usual means, without greatly contaminating the water with solid muddy impurities. We have seen at country roadsides springs, from which villages had to be supplied, so shallow that there was not an inch and a half depth of water: it was only by careful skimming, as it were, that a pure supply could be obtained. But this carefulness was by no means the rule on the part of those frequenting the spring for supplies; hence he who got first generally obtained the only pure water. A *little* mud may to some be no great objection, as it soon settles; yet it nevertheless taints the water. In such cases as the above, it is no use to scoop out a hollow place in the bed of the spring—as we have sometimes known to be attempted—as in a short time it is silted up. A simple contrivance such as the following will be worth the outlay expended in placing it. Provide a stone trough, or a wood one—made in the manner hereafter described when treating of cisterns—some 12 or 15 inches deep, 2½ feet long, by 12 inches or so broad. Divide this by a water-tight partition, so that a space of 9 inches broad shall be left at one end, and of the depth of the trough. This partition shall only reach to within *two* inches of the top edges of the trough. The bottom of the large division *must* be perforated with numerous holes. Dig a hole in the earth from whence the spring issues, and put this trough therein, so that the upper edge shall be a little above the level of the ground. Ram tightly all round it stiff and good clay—the harder the better. The water from the spring will issue through the holes in the bottom of the large division of the trough, and any mud brought up will be deposited therein. As the clear water fills the trough, it will reach the top of the partition and run over it into the small division at the end, free from deposit. The supplies required should be taken from this division. In all cases where the spring issues at a level with the surrounding surface, this contrivance, or a simple trough with a perforated bottom, should be used, or a small well made.

The next source of supply to be noticed here, is that from *rivers* or *burns*. The water in these is derivable from two sources—rain water from the surface of the adjoining lands, and water from springs which may from various points run into the stream. The impurities in river water are apt to be numerous, both organic and

mineral. Much depends upon the nature of the ground the river passes over. Granite is perhaps the best material, slate the next. Chalky and sandy soils produce deterioration of the water, particularlyfor detergent purposes—the *saline* impregnation rendering it *hard*, as it is termed. Whatever be the kind of water employed—rain, spring, or river—filters should be used to free it from its solid and organic impurities. With reference to the cause of hardness of water, and the easiest methods of rendering it soft, we recommend the reader to the October number of this Journal, for the year 1849, No. XXVI., page 117, where he will find some excellent remarks by Mr Towers, with useful hints on this point.

As before noted, impure water acts most deleteriously on the health of the body: it therefore behoves every one to look to the water he partakes of daily. It is a fertile source of disease in many districts. When water has a tainted smell, and abounds in animal and vegetable impurities, it should never be used without purifying for cooking or drinking. As a rule, when it is in the slightest degree nauseous to the taste, it should be looked upon as deleterious to the body. We should recommend *all* water to be filtered before using it. The expense of doing this cannot, and ought not, to stand in the way of this being done. True, it may cost a little trouble at the first, but labour is demanded before anything necessary can be done; and where the outlay of this is objected to, we can have no pity if the penalty of this neglect is incurred. Rain water obtained directly from the clouds is the most solvent we can obtain. It is admirably adapted for cooking purposes; and if kept in a shady place, or put in a porous vessel with a damp cloth round, and thus rendered cool, it is most pleasant to drink. This mode of cooling water should be noted. Water, if over-warm, is sickly. 45°, however, should be the minimum of the reduced temperature to which the water should be cooled. It is a well-ascertained fact, that hard water, for cooking purposes, is prejudicial both to meat and vegetables. In the article of tea alone, when made by hard water, a large amount of the article is lost. It is calculated that the nation loses a large sum yearly by the use of hard water in cooking; and not only in this department, but also in washing, from the extra amount of soap required, and the consequently greater amount of wear and tear of the fabric. Hard water may be made in some degree soft by the addition of carbonate of soda; but it ought to be used sparingly in cooking, as it imparts an unpleasant taste to the substance cooked. For a better method, see Mr Towers' paper formerly alluded to.

It should be an essential feature in the construction of water-cisterns that no lead be employed in the interior. It would be a mere waste of time here to prove how deleterious is the action of lead upon water. It is now too well known to be disputed; and it is a fortunate matter that so good and cheap a substitute as *gutta percha* is obtainable and easily adapted. This substance

is very cheap, and, if need be, can be applied by any person able to handle the simplest tools. The cistern should be made of a size sufficient to contain a quantity available for the purposes required. If used for all purposes, a supply of 20 gallons a day for each individual will suffice for all wants; and should the rain water not be used for all purposes, less will suffice. It has been calculated that each 20 square feet of roof-surface will receive 800 cubic feet of water annually—equal to 4800 gallons, or 13½ daily. This is certainly worth collecting. The space of roof-surface required is very small; in the majority of cottages it will be much larger than that noted. By the adoption of properly constructed cisterns, the quantity received on the roof may be collected and preserved, and used for a variety of purposes, even although spring or river water may be used in some departments of household economy. As a ready means of calculating the quantity of water a cistern of given dimensions will contain, we give the following rule:—Multiply the length by the breadth, and the product thus obtained by the depth; the quotient will be the number of cubic feet. Then, as an approximation sufficiently near for practical purposes, allowing 6 gallons imperial to 1 cubic foot, multiply the last quotient obtained by 6, and the result will be the number of gallons the cistern or tank will hold. Thus: suppose a cistern to be 3 feet broad by 4 feet long, and 5 deep, the water it will hold is, $= 3 \times 4 \times 5 = 60 \times 6 = 360$ gallons.

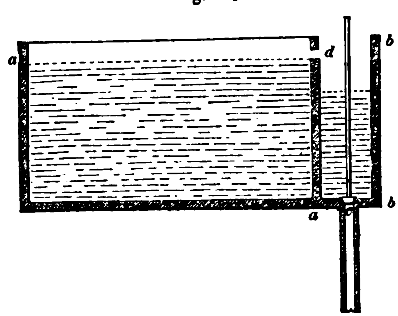
In constructing the cistern, the boards should be carefully tongued and grooved, and dovetailed at the joints. The gutta percha lining should then be stretched carefully over the inside, taking one side, or, if too large, part at a time; the sheets, or parts of sheets, should overlap one another at the joints at least three-eighths of an inch. After the inside is completely covered, the joints should be carefully gone over with a hot iron: this will make the edges cohere as firmly as the solid gutta percha. Before placing the covering, the holes for the discharge and waste pipes should be cut in the cistern; the gutta percha should cover these, and, when properly finished, the parts should be cut out for the reception of the pipes. There is not so much danger to be apprehended from the use of lead pipes of short lengths reaching from the cisterns to the desired place of exit, inasmuch as the surface is comparatively small, and the water not generally allowed to remain long in them. If water is not withdrawn very frequently, it will be advisable, when about to use it, to allow the water to run off for some time without collecting; this will pass off any tainted water, if such should exist. It would be worth the consideration, however, of parties wishing to economise in structural details, whether gutta percha pipes are not preferable in every respect to lead ones; they are certainly much cheaper; and in the event of any damage being done to them, repairs can be made by the most inexperienced hand. Gutta percha pipe may be had of

all dimensions. A useful size, 1 inch diameter, can be had at the rate of 8d. per foot, or thereabouts. The method of joining the lengths is very simple, and may be undertaken by any one. Printed instructions on this point may be had *gratis*, on application to the Gutta Percha Company, 18 Wharf Road, City Road, London. In fastening the pipes to the cistern, a flange about 1 inch larger all round than the diameter of pipe should be fastened to one end of it by means of a hot iron; or a short length of pipe, with the flange in one solid piece, may be obtained. The tube or pipe to which the flange is attached should be passed through the aperture previously made in the side or bottom of the cistern, so that the flange will lie flat on the inside gutta percha lining. By passing a hot iron over the edge of the flange, so as to make it cohere with the lining of the cistern, a perfectly water-tight joint can be made in a very short time. In place of using gutta percha in solid sheets, the *solution* similar to that used for putting on shoe-soles with may be economically adopted, and will be found very successful. An engineer of the author's acquaintance was the first to employ it in lining a cistern used for supplying a boiler with water. In rendering cisterns waterproof by this method, the first operation necessary to be done is to make the inside of the cistern as dry and free from damp as possible. To insure this, it may be placed before an open fire, so that the heat may be reflected into the interior, or the cistern may be inverted over a brazier of burning charcoal. After the interior is well dried, the whole internal surface must be punctured with holes made by a *sprig-bit* or *awl*. The holes should be made slanting, or at an angle with the surface of the wood. To save the trouble of making the numerous holes required, a steel flat-headed instrument may be used, having on its surface projections about one-eighth of an inch long, and the same distance apart. By striking the end of this instrument with a mallet, the head being applied to the surface of the wood, a large number of holes may be made in a short space of time. A quantity of the solution must next be melted in a common water glue-pot till about the consistence of thickish glue; and this, with a hard brush, must be well rubbed in the interior of the cistern till the whole surface is covered. The solution filling each perforation, and hardening therein, takes consequently a firm hold. After the first coating is thoroughly dry, another may in like manner be put on. If this is done carefully, so that every portion of surface is covered, the wood will remain uninjured by damp for a great length of time. By the adoption of either of these plans, cisterns may be lined with a water-tight covering, exercising no deleterious influence on the quality of the water, and provided at a cost far below the usual lead coverings.

As it is of importance in well-devised arrangements, whether

connected with houses or manufactures, that nothing should be allowed to go to waste, it will be well to devise some means whereby the *surplus* water collected in the cisterns—be these supplied direct from the heavens or from other sources—may be made available for useful purposes. The most obvious is the cleaning or flushing of the drains. We have before sufficiently enlarged on the importance of using water as a vehicle for this purpose; the sooner solid matter is removed from the drains to the manure-tank the better. The easiest plan to pass the surplus water of the cistern to the drains is, by having the discharge-pipe, which should be placed near the top of the cistern, to communicate with the drain; so that whenever any surplus water was occasioned, it would at once pass to the drain. The casual quantities thus obtained would, however, pass down the pipe with so little force that the *sudden removal* of the solid matter would be comparatively unattained. This desideratum, which flushing effects, depends on the momentum of a body of water suddenly admitted to the pipes or drains. It will therefore be best to provide means by which the surplus water can be collected in sufficient quantity, so that, when allowed to pass off, the rush will have sufficient force to clear all deposits in the drain before it. It is to be premised, before describing arrangements for this purpose, that it is necessary, in order to insure the full benefit of the plan, that the surplus water should be directly admitted to the *head* of the drain—that is, at the part *farthest* from the manure-tank. By this the cleansing of the whole range of drain will be insured. In fig 18, we have given a sketch of an arrangement in which the cistern for the usual supply, and that for the surplus or flushing water, are combined in one—thus, *a a* is the part from which the usual supplies are taken; a partition *d* at one end cuts off a portion *b b*, which forms the reservoir for the surplus water; near the top edge of this partition, a hole is made through which the surplus water passes to *b b*; or the partition *d* may be made lower than the sides of the cistern, thus allowing the surplus water, when above a certain height, to flow over it into *b b*. For the purpose of withdrawing the water from *b b* to pass into the drain, an aperture is made in the bottom of *b b*, communicating with the drain; a plug or valve *c*, having a rod as in the drawing, should be fitted to this. By taking out the plug at convenient opportunities, the water can be sent into the drain with consider-

Fig. 18.



able force. The plug may be made of wood, having rope yarn bound tightly round it, or it may be covered with leather or gutta percha, either of which will answer the purpose sufficiently well. In fig. 19, Mr Guthrie's form of flushing cistern is shown. A pipe *a a* leads the surplus water to the conical cistern *b b*, at the bottom of which a valve *c* is placed, connected by a chain *h h* to the end of a lever *g*, oscillating on a support *f*; a rope or cord *k k* is attached to the other end of the lever, by pulling down which the valve *c* is withdrawn from its seat, and the water rushes down the pipe *d* to the drain. If the conical cistern should get too full, the water runs down into *d* by means of the pipe *e e*. The objection to this waste-pipe is, that the foul air from the drain can get access to the interior of the cistern, and from thence to the place in which it may be situated. This objection may, however, be got rid of by trapping the pipe *e e* as it enters *d*, by continuing it a little farther and turning it up into a syphon form. The flushing cistern may be made self-acting, obviating the necessity of withdrawing the plug or valve by hand, as in the two last contrivances, and the trapping of the waste-pipe as in fig. 19. This may be seen in the following arrangement. Let the flushing cistern *a a*, fig. 20, be supplied with a tube, *b b*, as before, leading to the drain; this cistern may form part of a supply one, as in fig. 18: let a valve *c* with its spindle be placed in the seat, at the top of the pipe *b*, then pass over the spindle the support *e e*, having a hole in its centre as at *m*, through which the spindle works; this support may be fastened by simply driving nails through apertures made in the flat turned or angular hilts *a′ a′*; next fasten the hollow float *d*, made of painted tin or hollow gutta percha, and place as in the figure the other support at the top. By these supports the spindle will be kept steady, and the valve *c* will drop readily into its place. As soon as the water rises to a certain height in the flushing cistern, the float will rise, taking with it the valve spindle and valve *c*, allowing the water to run down the pipe *b b*; and as soon as the water falls, the float will descend, and the valve be

Fig. 19.

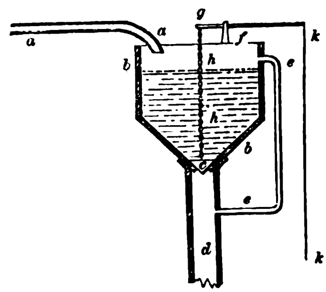
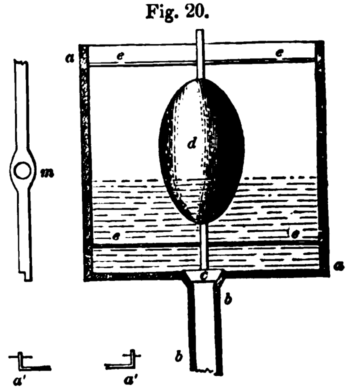


Fig. 20.



deposited in its place. By placing weights on the valve spindle, the float may be made to rise as soon as the water reaches the desired height. In this plan the water will not rush very rapidly down the pipe *b b;* nevertheless, as the exit of the water will be rather frequent, deposits of solid matter may be prevented taking place in the drains. The method of making the various details of the plans we offer in this and other departments, will be given under the engineering head of our paper.

It is of vast importance that the rain water used for household purposes should be filtered. The same should be done with spring or other water, unless very pure. In fig. 21 a sketch of a filtering cistern is given. A narrow division at one end of the large cistern is made by a partition *a b*, as in the drawing. This partition must not quite reach the bottom, but a space be left through which the water can pass from the large division to the small one. The water to be filtered is admitted to the large division first, and passes through the aperture above noted, up through the filtering medium *g* and into *e e*, from whence it is withdrawn through the pipe *f*. As the water is drawn from *e e*, that in *a a*, from its tendency to find its level, will pass through the aperture *b*, and up through *g* as before. The filtering medium may be arrayed as follows—first, in the bottom place a layer of clean round pebbles and pieces of broken earthenware; above this, small clean gravel, then coarsely pounded charcoal, a second layer of gravel, and lastly, clean sharp sand. A good filtering medium may be made by placing a layer of gravel at bottom; above this a layer of coarse wool, then a layer of finer wool, and above these one of gravel. In place of having the position of the filtering medium as in the last, it may be situated in a box *b b*, (fig. 22,) with a perforated bottom *c c*, the water being admitted to *e* through the pipe *d;* passing through the filtering medium, it will be delivered to the body of the cistern, from which it may be drawn free from impurities in the usual way. If a portable filter is required for spring, burn, or rain water, one made as in fig. 23 will be effective. A water-tight box, *a a*, should have a stop-cock, *b*, to withdraw its contents at the bottom; it should be supported by legs, *c c*,

Fig. 21.

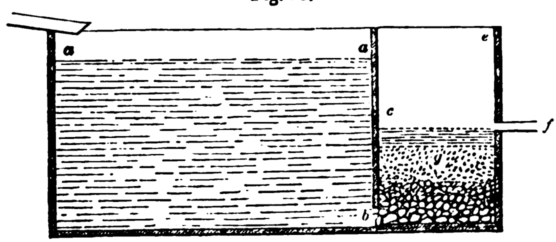
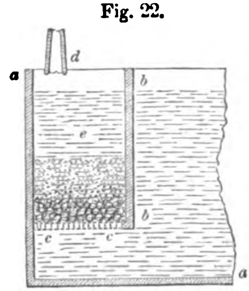


Fig. 22.



sufficiently long to raise the box so as to allow a vessel to be placed underneath the stop-cock *b*, to receive the filtered water.

Fig. 23.

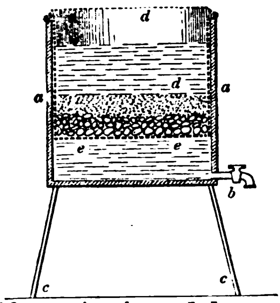
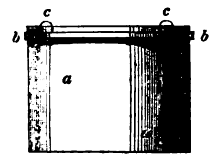
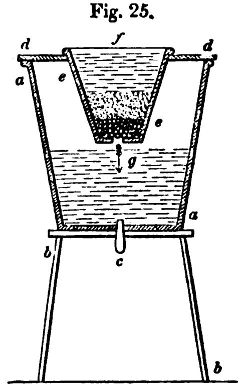


Fig. 24.



Provide a zinc box, *d d*, or one made of wood, lined with gutta percha, similar to that in fig. 24. This box should have a perforated bottom, and a bead, *b b*, at the upper edge, or other contrivance so as to prevent it from going into the box *a a* farther than requisite; the box may have handles, *c c*, to lift it out and in. The filtering medium should be arranged in the bottom of this box as in the sketch; the water admitted to it passes through the filter and into the part *e e* of the outer box; nearly fed whole of the box *a a* may be made available water-space by placing the bead or ledge of the filtering-box near the bottom, which will keep it farther up in the box *a a*. By adopting the plan sketched in fig. 25, a still more simple and inexpensive water-filter may be made. A large flower-pot, *a a*, is provided with a plug, *c*, or stop-cock, by which the filtered water may be drawn off; a circular frame of wood, *d d*, of a little larger diameter than the diameter of the pot *a a*, should lie on the top ledge; this frame has a hole or aperture in the centre, of size sufficient to allow a smaller flower-pot, *e e*, to pass down into the interior of the large one, yet to hang by its ledge or rim, as in the drawing; the whole apparatus is supported on legs, *b b*. The filtering medium is placed in the small pot, and the water passes through this from *f*, and is delivered to the interior of the large pot, from whence it is withdrawn by the plug or stop-cock *c*.

Fig. 25.

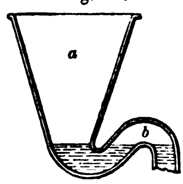


Before leaving this branch of the subject, it may be well to note that, in all cases where rain-water cisterns are adopted, it would be advisable to place them at as high an elevation as possible above the ground. This will give the water a considerable momentum in descending to the drain, and will also be more easily available for household purposes than when stored in tanks made under ground, as has in some places been recommended.

We shall now proceed to the consideration of an important part of our subject—the arrangement and construction of *water-closets.* And here it is necessary to state the opinion clearly, in which all acquainted with the matter coincide, that all *privies* should be water-closets—that is, *water* should in all cases be the medium of carrying off the matter as fast as possible, and that the terminus for all deposits should be the liquid-manure tank; moreover, that the gases evolved should be strictly prevented from having access to the external air, or to any part of the house if the closet should be situated therein. Taking this to be the standard of perfection, it is to be understood that all deviation from it will result in positive loss or inconvenience, proportionate to the amount of such deviation. It is, we hope, here utterly unnecessary to dilate on the advantages to be derived from liquid manure, from dwelling-houses, for horticultural or agricultural purposes; the fact of its value is, or ought to be, patent to all. A method, then, of saving the household exuviæ, and of speedily carrying it off to the manure tank, is of considerable importance; and the easiest way to insure this is by the use of the important vehicle water. In these departments we may be charged with aiming at too high an excellence in details of arrangement or construction; but we conceive it of importance that the plans we indicate should, at least, be comparatively complete. We endeavour to give good advice: the following of it rests with others. If our plans, or modifications of them, are carried out in any one case, the proprietor may rest assured that he has insured the means of securing health and comfort, so far at least as they are attainable by structural arrangements.

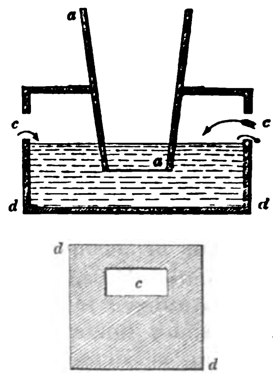
If the water-closet is placed within the house—a matter which we leave to the dictation of personal opinion, although ours is decidedly in favour of exterior arrangements, or at least, if they *are* interior, that they must be well ventilated—the soil-pan should at once communicate with the drain leading to the manure tank. In fig. 26 a sketch is given of a soil-pan combining a water-trap, up which the foul air cannot ascend, as may be seen in the drawing. The whole is made of earthenware, and the cost varies from 4s. to 7s. 6d. A better plan, or cheaper than this, cannot be adopted. The pottery water-closet, manufactured by John Ridgway & Co., Cauldon Place, Staffordshire Potteries, may also be used. They are neat, and made of the hard vitreous pottery, which is an admirable non-absorbent material. They are recommended by the Board of Health. It is equally applicable to closets in and out of doors. In cases where the privy is built outside, and the seat communicates at once with a cesspool placed beneath it, a well trapped-soil-pan, such as that shown in fig. 26, should invariably be adopted. In cases where these are not available, a simple arrangement may be

Fig. 26.



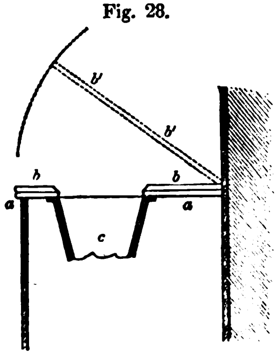
effected at a very trifling cost. A box, *d d*, fig. 27, may be made of any dimensions, with holes, *c c*, in the ends near the top; a tapering box, *a a*, should pass through an aperture in the top of the box *d d*, and be firmly fastened; the upper end of the tapering box, *a a*, forms the seat of the closet, and may be covered with a flap if required. An inspection of the drawing will show how the foul air from the cesspool is prevented from ascending the box *a a*, which is the only communication afforded with the cesspool. The liquid and exuviæ passing from the box *a a* will pass from the box *d d* by the apertures *c c* into the cesspool, from whence they may be removed, when necessary, by obvious means.

Fig. 27.



By the adoption of a well-trapped soil-pan the air of the cesspool will be closely confined, and the value of the manure will therefore remain unimpaired, the ammoniacal gases being retained and absorbed. In all cases a pipe should be led from the rain-water tank to the top of the soil-pan beneath the flap cover. A stop-cock should be fastened on this pipe somewhere within reach, which, being opened when necessary, will allow the water to flush the soil-pan and trap. In cases where the water-closet is near or within the house, a portion of the refuse-water from the kitchen may, from time to time, be sent down the soil-pan of the closet with advantage. As this practice—which is not to be recommended before the special and legitimate means of flushing the soil-pan—will, if carelessly done, sometimes wet the flap seat, the following contrivance (recommended, if we mistake not, by the late Mr Loudon, to a Committee of the House of Commons) may be adopted. A seat, *a a*, fig. 28, with circular aperture, is provided and permanently fixed. A similar one, *b b*, is to be hinged, so as to move up and be placed against the wall. This is the seat to be used. When not in use, it is opened and placed against the wall; so that if any water be passed down the pan *c*, and wets the permanent seat *a a*, the movable flap *b b* can be brought down and placed above *a a*. The dotted lines *b′ b′* show the movable flap in the act of being opened. In fig. 29 we have given an illustration explanatory of an arrangement in which the rain-water cistern, water-closet, and liquid-manure tank are combined in one. This possesses many advantages. The walls

Fig. 28.



a a are carried down a sufficient depth, as at *a′ a′*, to form the liquid-manure tank. An arched bottom, *b b*, may be provided if the tank is of large dimensions. In fig. 30 the plan is given. A stone flag, *c c*, is thrown across at the level of the ground, which forms the covering of the tank and the floor of the closet. This flag reaches only a certain distance across the opening of the tank, leaving a space, *o o*, through which the contents of the tank may be removed. In ordinary times this aperture is tightly covered with a board, in the centre of which is the aperture and cover *e e*, to which is attached the soil-pan *f*, and trap *g*. The front *d* may be made advantageously of stone. The water cistern, *h h*, is supported on two wooden beams, *m m*, at the top of the closet, by which the necessary elevation may be obtained. The dotted line, *i i*, indicates the line of direction of the water-pipe leading from the cistern to the soil-pan. In this form of water-closet the trap to the soil-pan may be dispensed with, by merely making the termination of the soil-pan in the form of a pipe, and leading it within a short distance of the bottom of the liquid-manure tank. In this case no foul air can escape up the tube, the aperture being always surrounded with water — the only surface from which smell could arise being the small portion at the bottom of the pipe; but in all forms of traps this exists. It is, therefore, essential to make this surface as small as possible, consistent with the insuring a free passage for the exuviæ.

Fig. 29.

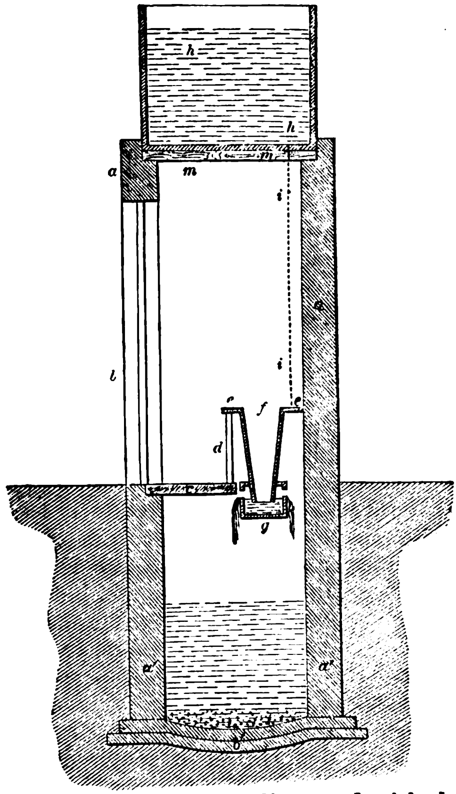
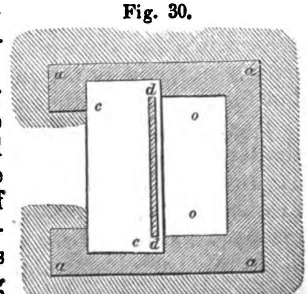


Fig. 30.



SHELTER A NECESSARY PRELIMINARY TO IMPROVEMENT.

By Mr Donald Bain, Edinburgh.

It is now several years since I have obtruded myself, upon the subject of *shelter;* but I have never forgotten the subject, nor neglected any opportunity of testing the soundness of my opinions, either by conversation with persons of experience, or by observed facts.

It has given me the greatest pleasure to observe that the subject of shelter has not only been considered important, but my treatment of it sound. I noticed and quoted the opinion of a meeting of practical agriculturists, held at Inverness several years ago—to the purport, that even in the cold and flat districts of Lochaber, were shelter resorted to on the barest moors, they might soon be whitened by such flocks as are the pride, and form the wealth, of Easter Ross.

The *Farmers' and Gardeners' Journal*, though an English publication, in reviewing my "*Observations on the Potato Blight of* 1846 *and* 1847," generously went out of its way to say that, upon *shelter*, so valuable to many parts of the kingdom, I had not only originated, but almost exhausted the subject.

The *Book of the Farm* has raised shelter into an element of agricultural prosperity; and—scarcely less important to the spread of the subject—all the cheap manuals on farms and farming recently published, not only give *shelter* a section, in the view of inculcating its utility to vegetable life, but also recur to its principles and value in speaking of the rearing and feeding of stock; and in these two last respects, and in reference to the keeping of stock generally, it is almost impossible to speak with sufficient emphasis of the value of a due climate.

And it is not in Scotland only, or in that and the north of England, that shelter is required. The northern and western parts of Ireland are equally crying out for it; and even in the beautiful south, instead of doing harm, it imparts a warmth at some seasons nearly tropical; not only to the great embellishment of the country, but to the increase of the pastures, and even *the preservation of them and the cattle against summer heat as well as winter cold*, and to *the perfection and ripening of many crops*, that but for the climate thus created could not be perfected.

I am at last so satisfied of the value and necessity of shelter over the larger portion of these kingdoms, that, instead of pleading for it as profitable, and a great auxiliary to improvement, I am inclined to state it to be *a necessary and indispensable preliminary to all improvement*, at least if we would have it *duly profitable*. There is no doubt that by draining and cultivating and manuring we may greatly improve the land, and the amount and quality of its crops; and there is no doubt that by these means we *have* immensely improved both;

but judicious shelter, where necessary, would immensely farther have improved both the land and the crops, whether these last should be of grain, or of vegetables, or pasture; and also in like proportion have furthered the comfort, and the health, and the growth of the animals fed upon them, whether in the fields or in the stall.

In travelling over almost any part of Scotland, and viewing its bleak fields in a bleak day, we are almost surprised that any one should be *so foolish* as to waste their labour in trying to raise crops in such circumstances. The grass is meagre, watery, and short, and the cattle seem almost as if their limbs were tied together, by their miserably shrinking from the cold. Is there a crop coming up? the clods and stones, that are a disgrace and annoyance to the farmer, seem yet godsends to his crop, for *they shelter it;* and hence it is even yet remembered that many fields were rendered comparatively barren *by the removal of the stones* that sheltered the young braird against bleak winds, and cherished it by reverberating the heat of the sun. Old and observing farmers also deprecate the early pasturing of grass, expressly on the ground that *by leaving the farther advanced crop you protect the young shoots; and*, e converso, *by removing the earlier blades, check the growth of the later by removing their shelter.* Surely this alone is a very strong fact to have escaped impressing the natural and obvious conclusion, that nature should be assisted in a case so clamant.

I have shown, at a very early stage of these observations, how the cold blasts act upon timber; that they cut the tree-tops as with a knife, in the precise angle of the coping of the wall. This was shown by a drawing from nature, and it may be witnessed in a thousand instances. When the angle of the coping is sharp, the blast is turned sharply up, and only a very few trees on the outside of the plantation are injured; when the angle is less sharp, the blast cuts farther in; and where the top of the dike is flat, hardly anything of value rises higher than the wall. By the angle given to a door or window shutter, *the blast entering a house or shop may be similarly controlled;* yet it is strange, the dikes for fields and plantations continue to be coped in a rough and *purposeless manner;* and half the value of the shelter, or rather almost the entire value of the shelter, is lost by this inattention to the mere form of the top of the wall.

In the same drawing above referred to, I was able to show also the effect of the blast, in what may be termed warping the branches of trees that have got up so far. The natural tendency of the boughs is to expand on all sides; but what a few genial months send out in a horizontal direction, the first cold blast turns back and bends, and entangles with other unfortunate branches, till *all* are bent and entangled—

"And as the twig is bent, *the tree's* inclined."

And certainly this is true of all the branches.

This, therefore, is the history of all those bent and gnarled boughs to be noticed in hedgerow trees—that is, trees standing exposed on all sides. Their boughs are uniformly bent and intertwined in the most fantastic manner; sometimes even leaning upon one another, and partially cutting into one another; and sometimes *firmly incorporating;* but the head as a whole is almost uniformly cut by, and bending before, the prevailing wind. Sometimes this is so marked that the tops become wholly unbalanced, leaning to and bearing wood only on one side. In one instance near Edinburgh this is so completely the case that on one side (that facing the east) *there are no branches whatever—not the slightest twig: the whole growth tends to the west.* It would seem as if the boughs on the east side had been completely cleared off by the knife, but it is by the east wind.

In many places on the east coast of Aberdeenshire, even far inland, attempts at hedgerow trees, or trees along the road-side, have been made; and though *judiciously* planted, yet, being planted unsheltered on the *east* side of the wall, they are miserable failures; dwarfed, and gnarled, and *fogged*, on the side to the weather; as if nature saw the necessity of that shelter which man denies, and provided a covering of lichens in the absence of other protection.

Solitary trees or small clumps standing in the neighbourhood of farm-houses, generally on little heights, or in valleys swept by the wind, have uniformly the same fate: *they are stunted.* Ash-trees so planted will stand for forty or fifty years, *and not be perceptibly larger*—(this is an observed fact;) while in a proper soil *and sheltered*, the same species of trees will in forty or fifty years rise to *great height and size*—(a fact doubtless well known.)

In evidence of this, (if evidence were needed,) a friend in East Lothian, whose house is built on the very top of a considerable rise, by planting the finer timber *west of his house*, and protecting some coarse shrubs on the east by a wall, has surrounded himself by a grove; and in a spot in the centre of that grove, which was in his young days a *whin-hill*, has a fruit and flower garden of the greatest fertility; while a hollow ravine in the immediate neighbourhood, which a few years ago was covered with heath and stones, with a plashy runnel at bottom in the winter, is now, by being sheltered, drained, and cleared of stones, *an orchard abounding in fruit*, and containing and sheltering numbers of thriving bee-hives, to enjoy and turn into money the very blossoms of his gardens and fields.*

Can it be supposed for a moment that the same winds that affect the timber trees, stunting and gnarling them in so extraordinary a manner, do not affect every vegetable in a similar manner? They

* Andrew Howden, Esq., Lawhead, who has died since these lines were written. *Amicis quam deflendus!*

do so from the tiniest grass up to the barley, wheat, and oat—all majestic when in their full proportions; and the turnip, mangold, and cabbage,—*all grow luxuriantly* in a suitable soil *when well protected;* but plant them in the richest soil, *but unprotected*, and see what they will be. The barley, oats, and wheat, will be dwarfs; the mangold will lie sprawling on the ground, not larger than a "kail-castock," nor more useful; the cabbage will be a miserable "bow-kail,"—and its root, instead of being two inches across, and straight, and supporting a top like a drum-head, a miserable twisted sow-tail, supporting an attempt at a head, about the size of an ordinary orange.

I saw a very remarkable instance at once of the benefit of shelter, and of the loss arising from the want of it, last year, near Aberdeen.

The Inch or ridge of Nigg, rising between the old course of the Dee (now a fertile valley, terminating in the Bay of Nigg) and the present course of the Dee (a beautiful estuary, and harbour crowded with vessels;)—well, this Inch of Nigg is very fertile, and, besides containing the little village of Torry, and the classical "Binnie-gask," (Balnagask,) contains several well-cultivated but unsheltered farms, and ends at last in one of the easternmost points of Scotland—the Girdleness.

Upon this point a magnificent light-house has been erected, surrounded by walls; but the walls enclose only a few acres of domain belonging to the light-house. All the rest is not only unsheltered, but in many places is unenclosed, and is nowhere enclosed properly. From the western wall of the light-house, therefore, cultivation is conducted on the old principle. The people have not thought of *provoking Providence* (as Madge Headrigg would say) *by creating a climate for their own particular use!* On the contrary, except for a *bottom of turf wall*, the land is open to the east wind, fresh from the German Ocean, and it sweeps up the face of that beautiful brae in unbroken severity.

The consequence is, that at the eastern margin of the field the oat stalk was only about *three inches in length*, and slender in proportion, and bearing *three pickles*, or what seemed to be such, and trembling like the aspen. In about thirty or forty yards, the stalk might be *five or six inches tall*, and bearing four pickles and a deaf one; and after crossing the ridge, and on the rich and *naturally sheltered* and sunny side of the Inch, the crop was of the usual unenclosed standard—namely, 15 or 16 inches high, but not more; slender, yet not close, and no way inclined to lodge.

The light-house is on a point projecting a quarter of a mile farther into the sea, which surrounds it on three sides, and, consequently, it would *naturally* be colder to a very great extent; but its grounds have been enclosed, and so sheltered by a wall, perhaps

6 feet high. What is the consequence? *Upon this spot*, so much nearer to the sea, and liable to be lashed by its spray, the oats were close and luxuriant, and 4 or 5 feet high! but quite upright, and the stalks heaving in the gentlest breeze possible, and seemingly whispering of the benefits of shelter. The turnips farther in were luxuriant, and without a stunted leaf or a yellow tip on any of their leaves; and the potatoes matched both. All was warmth and luxuriance. The spot is in fact protruded into the German Ocean about a quarter of a mile farther than any spot in its neighbourhood, but the crops show no sense of this; and it is quite clear that you might push them all the way to Norway, right in the eye of the east wind, and, if the space were sheltered as this little tongue is, they would not care. Need I contrast the profit of these two species of culture? The unsheltered spot would not return the seed. The crop would not, in all probability, be cut. The field, so far, had better not been cultivated; for the labour and manure, as well as the seed, were wholly wasted, as well as the soil, every way valuable in a country like this. On the other hand, the sheltered spot was producing *a rich return*, and this *when, but for the shelter*, *nothing whatever would have grown.*

Go inland even a great way in this county, and there is no crop like this. And why? Because there is no shelter like this. It beats even the crops in the alluvial hollows along the banks of the river.

I need not mention "the Hills of Foudlin," in the very centre of the county, producing only the roughest pasture, *in the immediate vicinity of the rich*, *because the sheltered*, *Vale of Fyvie.* These hills might be made as rich, for they are comparatively level—a valuable but neglected table-land, with occasionally the most romantic hollows. All along the road to Ellon, Peterhead, &c., the land, though low, is watery and mossy and cold, and the trees and crops stunted: *for the same reason—there is no shelter.* Were a belt of wood judiciously placed so as to exclude the east wind, and making it worth while to drain and cultivate the land, the vicinity of the sea would not be felt by the crops; the exposure to the east would not be felt; there would be comparatively little rain, because there would be no swamps to load the air with vapour; the sun would not be impeded in its passage to the earth by that vapour, nor its effects averted by a scourging wind. Yet, even in the neighbourhood of Ellon, a low-lying and fertile spot, there is no shelter deserving the name: all is left to nature, and it punishes them accordingly. The Romans would be surprised to find the *Ithuna* (Ythan) as bare as when they crossed it nearly two thousand years ago, and the people not much more informed in agriculture.

A casual traveller riding over the western parts of Ireland, and who certainly has never heard of these Essays on Shelter, yet yields the following unexpected testimony in its favour:—

On the road from Cork to Bantry, (says Mr Thackeray,) the character of the landscape is, for the most part, *bare and sad*, except here and there in the neighbourhood of the towns, where the people have taken a fancy to *plant*, and where nature has helped them, as it almost always will in this country. *If we saw a field with a good hedge to it, we were sure to see a good crop inside; but many a field was there that had neither hedge nor crop.*—(*Sketch-Book of Ireland*, 1843.)

We might here exclaim, Was there ever a people so infatuated! Heaven gives soil and climate, but, in order to give people something to do, leaves them to enclose and cultivate the land to their taste, just as it does to dress themselves; and they go in rags themselves, and leave the land naked. But this is not the fault of the people of Ireland, but of the landlords—or, shall we say it?—of *the Government*. The people have, for the most part, no leases; no assurance, therefore, of reaping the fruits of their toil, but the contrary; and, in such circumstances, no man can be *expected* to toil. Even the example of Scotland, in their very midst, has not taught the landlords or the Government better. But the destruction that has fallen upon so many may. Even *Scotland*, with all its industry and intelligence, has yet failed to see the value of shelter on a large scale. It has made efforts in clumps, and in patches here and there, but has not as yet risen to the idea of a comprehensive system. I do not call this a fault—it is a temporary misfortune; the idea has not yet been sufficiently impressed; and the theory is even repressed by the fact, that trivial patches of shelter hardly do any good. Surely, however, even the few facts I have adduced are important, and lead to the most important conclusions; namely, that *with shelter* we may almost do all things—without it, scarcely anything; for without a proper *climate*, (which, in this country, shelter alone can give in nine cases out of ten,) all efforts to raise a crop, whether of wood or of vegetation of any description, is wholly useless—while *with shelter*, and, I need not add, draining and manure, the bleakest spot is made *warm*, and the desert to blossom like the rose.

In short, by judicious shelter on a large scale *we should be manufacturing climate on a national principle*;—by following it on *a small scale*, we are sticking to *the cottier principle*; and that may be said generally to be only exceptional in any matter.

To come closer: What are even the houses we live in but *shelters?* What the clothes we wear but *shelters?* In sheltering the country, we are only *suitably clothing it*; in providing, in addition, retreats for the animals we wish to rear, we are *housing it*. So far as we leave the country unsheltered, undrained, and uncultivated, we are leaving it in a state of nature and barbarism. We might as well leave ourselves in the same condition as the country that has been given us to live in and enjoy.

But many will say, that though the benefit of shelter is understood, and even its *necessity* in *some cases* is understood, yet *it cannot be afforded—the expense is too great.*

In answer to this, I might say at once, that no expense we can be put to in sheltering and cultivating even Scotland, can equal the expense that has been necessary to bring even into light the most beautiful result of industry known to us—and that is *Holland.* But if the expense I propose is supposed to be anything rendering the returns from it doubtful even for a moment, then my principles are not understood, and the loss accruing from not following them is not seen.

It does seem as if *the masses of snow* that used to fall in such profusion, and bury the whole land for months, and so render the lives of sheep, in particular, in the last degree precarious, both from its falling so heavily and lying so long, do not now fall. This must arise, as has been already hinted, from less water stagnating on the land, causing less vapour to rise, and giving, therefore, less to fall in rain or snow.

Of this, the following would seem the principles: Water evaporates much more rapidly from a shallow vessel than from a deep one, its temperature being so much more easily altered; it evaporates more rapidly still from a merely *wetted surface.* More vapour would, therefore, unquestionably rise from a *wet field* or undrained mountain-side than either from a lake, a river, or the sea; and into one or other of these the whole rain that falls is now conveyed as speedily as possible—the area of lakes themselves being also every day suffering diminution. I would thus account for less vapour rising, and consequently less snow or rain falling.

Still, no doubt, in the hill countries there is much more both of snow and rain, and more of suffering from both, than the inhabitants of towns can conceive; and the enemy of animal life yet more formidable than either rain or snow—I mean the east wind—is wholly unobserved. This last alone must ever point to the necessity of shelter *for itself;* but it is almost more important still, from the fact, that rendering land more valuable by the power of occupancy it gives, it leads to more anxiety in cultivating and draining. For the vapour that still rises, the hills, as every one knows, from being high and cold, in consequence of exposure to every wind, and no reverberation or retention of heat, condense the vapours over them, and cause them to fall in snow or rain. If these hills are allowed to continue cold, and the snow or rain falling upon them to lie upon them, there must be a long-continued action and reaction of cold, or long periods of what is called "settled storm."

The care of these hills, therefore, is not less important than the care of more valuable ground; for, in their natural state, they are *natural refrigerators* to their extent; natural producers of cold to whole districts.

It will be remembered, therefore, that I recommended running

belts of plantation round even pinnacled hills, at such distance from one another as that the one belt should shelter the space between it and the next. This was both to warm the hill and produce pasture. I also recommended "letting out," and running off, all these collections of water so frequent on the faces of hills, if only to extend the pastures and render them more sound. It is now obvious that the combined operations of *sheltering*, and thus, as it were, *draining the hills*, would both make them warmer by allowing the sun's heat to take effect, and less productive of vapour, by running the water off.

I should be accused of becoming imaginative were I to recall, in a condensed form, all that I have said of *scarifying* rough spots even in the hills, to render finer the pasture; of *partially manuring*, to render it more abundant; of *sowing crops, for the use of cattle or for game*, to feed the first more abundantly, and to keep the other to their proper quarters. Yet, at any risk, I must recall these suggestions, for their effects would be of *the utmost value.* They would not only increase incredibly the pasture of the hills, and their power of sustaining cattle, sheep, and game, and of sustaining them not only more abundantly, but in perfect comfort; but they would tend amazingly to improve the climate of the country in general; and until they shall be thus improved, we are decidedly, and almost shamefully, neglecting the country that has been given to us.

Many can yet remember since, on cultivating a farm, (as cultivation then went,) every earthfast stone, every trifling swamp, and even every trivial mound of shingle or accidental rickle of stones, was passed by, and baulks, as they were called, formed, or permitted to remain, without end. Perhaps there was then no encouragement to act otherwise. So different has the system been, for now many years, that farms, about sixty years ago considered arable to the extent of only 250 acres, are now, without any change in the boundaries, arable to the extent of 1000 acres, being *all arable.* What is a hill or a mountain, but a more elevated portion of the general land? Its capabilities, therefore, should be looked at as carefully as the capabilities of the plain; and if, by a little attention, these can be rendered productive of shelter and food for animals, and through them for man, an accession is not only made to the nation's wealth, but, in pursuing that, to its comfort and its beauty.

Many table-lands at present of little value, and the lower ranges, in particular, of many of our hills, might, in this way, not only be turned into national beauties in place of deformities, but also into national blessings, from the scope they would give for labour, and afterwards space for residence.

I would not, of course, advise burning and trenching all the hills in the Highlands, nor even going far up, perhaps, on those

of the Lowlands. I would trench only where there was a certainty that, from the soil and climate as created, an adequate crop would grow; but I am quite certain that this would happen in many thousand instances where it is not at present suspected, and that the idea, once followed, would rapidly gain ground.

As instances, I have already adverted to the hills of Foudlin in Aberdeenshire, as naturally improvable, though at present of little value.

The Soutra Hills, in Mid-Lothian, are not only at present of little comparative value, but in winter are dangerous to travellers, from their cold and drifts. Yet were the table-land of the Soutras *sheltered*, and advantage taken of the many romantic sites, to build summer residences, also duly sheltered, they might form the most valuable and romantic spot almost in the kingdom, for they are crossed by an excellent road, and must, in the summer, be exceedingly healthful. But we go to wander among the *chalets* of Switzerland instead of forming them at home—though here, and in many other places, we might have spots as romantic as any that Switzerland can show.

For this, I believe, it would not be necessary that persons of fortune and fashion should be seduced to these wilds. We have only to lay down something of a plan, and give poor and industrious cultivators an interest to cultivate and embellish, even in their humble way, and the thing would be done; for persons in quest of health or pleasure would follow, and so increase the embellishments; though, if they could be induced to go, in the first instance, the improvement would be more striking.

But these are merely hints to induce landlords to think; that is, landlords having spots at present peculiarly useless, but with capabilities of improvement in them, from the system I propose.

As to the country in general, I consider myself entitled to say, that *all farmers who have ever turned their thoughts to the subject* admit the importance of *shelter* both to crops and cattle; and lament the misery of its absence. To the *unthinking*, this and any other miseries conceivable, that have been customary, appear to be also necessary.

There is certainly this *substantial* difficulty, as the farmer is concerned—namely, that few farmers can, in the course of a lease, expect to reap much of the benefits of any shelter that may be begun to be created during its currency. But it does not seem necessary to calculate that the farmer's possession must always end with his lease. There have been, and there are, instances on many estates, of the names of farmers remaining connected with possessions, while those of the landlords' have changed again and again; and true farmers should reason differently as to such an improvement as shelter. *They should refuse to waste their time and toil, and money and manure, in cropping spots in which crops*

can never grow to perfection, and require shelter for their crops and cattle, as decidedly as they now require suitable shelter for themselves; and more, *the landlord should as decidedly insist upon giving shelter to crops and cattle as he does on giving suitable shelter to the tenant himself, satisfied that he will be as certainly paid for it.*

It will be remembered that I do not require shelter *everywhere*, for it is not needed everywhere. I do not require that the country should be covered over with *paddocks*, any more than with five-acre farms. On the contrary, I war against all waste of the land in unnecessary plantations or hedges, or unnecessary erections of any kind. I propose no unnecessary *woods*. I would not have wood *a crop* at all, but the nurse of crops. I would even have the *belts* which I propose, so formed as that, while protecting the fields and pastures, they might themselves, in due time, be *pasturable;* and *never placed but where efficient*, nor occupying one foot of land more than necessary. I hope this will be remembered.

Ireland, however hitherto miserably neglected, as a whole seems to have been formed by nature on its most beautiful model; for its east coast, in many long ranges, particularly towards the south, supplies, in hills of the greatest beauty, natural barriers against the wind; and that, if in the slightest degree artificially assisted, would place *its rich interior basin in a perpetual calm.* But even these require *a degree of aid.*

Scotland has not been so happily formed. Its east coast is in general high enough with reference to the sea, *did the land sink behind it;* but this it seldom does. On the contrary, it is often, though high on the coast, yet higher in the interior; or, it is low on the coast, and offering a continuous sweep to the winds inland.

When high, and rising higher, it must begin its shelter at the coast, and repeat it at proper intervals, till it has reached the highest ground. *Then* a shelter placed on *that ground* will shelter inward, it may be for miles. This is my plan,—*not* to have a plantation surrounding every field, nor, it may be, round every estate; but by *a shelter* at *the opening of a valley, to protect the entire valley;* and by a shelter erected on an *advantageous height*, to shelter as far as possible into the hollows.

This has not been the principle followed hitherto. On the contrary, the height has been considered a sufficient shelter of itself; whereas it depends entirely upon its form whether it is any shelter whatever. If at all *rounded*, the cold wind or the snow curls over it, and it does not in the slightest degree protect anything within it. But *a very trivial addition of a proper form*—a dike with a coping properly sloped, and above all, a belt of tall trees—must, it is obvious, throw the gale *up, at an angle proportioned to the depth from which it comes*, and, as I have said, protect inwards for very many miles. A country *continuously protected in this manner*, against an injurious wind, must be singularly benefited. To give

an idea of it, we have only to think of the calm created behind a continuous wood. The great wall of *China* was never so useful against invaders, as would be such a shelter to Scotland against the invasion of the east wind. I consequently think we should never want work for our poor, while such a work remains to be done.

At least the poor might be so employed, or in ameliorating the country generally, at moderate wages, with the greatest benefit to themselves and the country; and I do not think that the rights of property would be infringed by *ruling*, that wherever needful shelter remains to be raised, or where there are large or even small tracts of country to reclaim, of moor or moss, or unsheltered hill or dell, the owners should do what is proper for their improvement, being assisted by loans if necessary; or resign the land to others, or the State, at its existing value, so that the improvement of the country might proceed.

Again, at present many noblemen pay heavily to their farmers for the trespasses of their deer, and even of other game. Suppose all parties to be satisfied by those payments, would not there be a gain in all directions, by the nobleman duly sheltering his hills, and taking advantage of any favourable spots to raise clover, barley, or whatever the game might like, within their own domains? I surely think so.

And there can be no doubt that, by sheltering the hills, removing superfluous water, clearing the course of mountain brooks, so as to avert those stops and gatherings of water in the case of thaws, by which so many sheep are often destroyed, and adopting the other particulars of "*hill-culture*," so earnestly recommended in these papers, an immense addition could be made to the pastures for sheep and cattle; an immense addition to their comfort, and consequently to their health and growth; great power created of preserving the young of sheep in spring, and the old in winter, by averting the consequences of casual colds, of heavy falls of snow, and, as just above mentioned, of sudden thaws. The very heavy percentage of young sheep that die, and of the old that are destroyed, and both from disregard of the very trivial appliances so necessary to their preservation, and so sure to preserve them, are sad evidences of apathy.

Nor is shelter for cattle less necessary in the low lands than in the high; nor would it be less profitable. I therefore conceive it indispensable that both landlords and farmers should take up this subject, if we would either cultivate or pasture with profit; or, what is now of the utmost importance, *compete with foreigners in either*.

There is another point connected with the care of both sheep and cattle, and having reference equally to home consumption and

foreign competition, with which shelter also materially connects itself.

I am not sure that our farmers have studied with as much care as foreign farmers, particularly Dutch farmers, the grasses and other substances capable of yielding the best flesh and milk. I believe no grass seeds are allowed to enter the Dutch market that have not been regularly inspected by a faithful officer, both as to their being of the kinds approved, and perfect in their kind; and I think this a very rational regulation.

Suppose this to be done here, I believe we almost alone in Europe have the soil proper to produce sweet grass for cattle, and capable of giving their flesh the due consistency; and we have confessedly outstript all others in the abundance and quality of our winter food.

Our meat, therefore, is not only excellent in quality, but may be, if we choose it, excellently mixed. *We* lie under no necessity of having meat exsiccated by the hunger of winter, and rendered incapable of again mixing with the fat produced by the abundance of summer, as is the case in most pasture countries. The elements of an agreeable and nutritive article are so finely blended in our choicer specimens, as to render the produce of our native herds and flocks the envy of any other country with which we are acquainted; and this excellence might be *general;* and now is the time when it is at once easy and necessary for us to outstrip the world.

To continue this: We no longer require to send our sheep and cattle to market by long journeys on foot, wasting in those journeys all that had made them valuable, and almost rendering them incapable of restoration, by so completely separating the fat from the lean by fatigue; we no longer require to have them sickened and knocked about in long voyages under adverse winds; we can send them by steam-ships, with no injury from the rolling of the vessel, and no longer fast than is necessary to prepare them for their doom, or by the railway, without either fasting or fatigue. Therefore the steam-ship or the rail is all that is necessary for us to desire to see extended to the neighbourhood of our pastures, so far as carriage is concerned; but it is very necessary to have these; and landlords, instead of demanding value for their land from railway companies, and extravagant value too, should, upon this and every account, rather *encourage the advent of the railroad by every means in their power.*

Through the railroad and the steam-boat we can also send *dead meat* to market, and, sending the more valuable parts to the towns, can leave the less valuable in the country, to find a comparatively better market there, and add much at the same time to the abundance of the country. But if we would render our produce universally excellent and abundant, we must *shelter our pas-*

tures, and, as I have farther ventured to term it, *house them*, so far as they are intended for *finishing feeding grounds*. The meat cannot be *excellent*, *nor produced in proper quantity*, *nor with profitable rapidity*, when the animal is *fatigued in seeking its food;* or when it is *interrupted in its feeding;* or when it is shrunk and attenuated by starving winds and wet. The shortest period of either of these disadvantages tells. To the full and proper and *profitable* development of animals of every species, *comfort is requisite*, as wéll as fulness of food: a full and proper development of the animals upon wholesome principles is necessary to our preserving the market for their flesh; and comfort cannot be enjoyed as a general thing, *in any pasture of this country*, *in its natural state*.

For all these reasons—and they are certainly numerous, and upon due consideration must, I think, be found to be of great weight—I cannot but again recommend *shelter*, as a general thing, for the improvement of the pastures and the comfort of the cattle; but in the final feeding-grounds, I must suggest *housing also*—that is, sheds into which the cattle may retire in heat or cold, or merely at their own pleasure for rest; for I think the resting on a damp or frozen bed must be as dangerous to an animal as to man.

I would combine with this comfort, *various feeding*, for the express purpose of *mixing the meat*, and rendering it valuable in fat as well as in the flesh, and even pleasing to the eye.

For example,—sheep fed exclusively upon turnips, or even upon turnips with the option of straw, do not always prosper—do not even live. The straw, unless very excellent, is not inviting; perhaps even if excellent, it is not. The sheep, therefore, do not *mix* their food sufficiently, either to mix the meat, or even to preserve health, when straw alone is added. A gentleman of great experience has mentioned, that upon turnips and straw alone he found his sheep *dying* to the extent of two or three a-week in not a large flock: he gave them the option of some bean-meal, and they not only became healthy, but in the end produced a far finer article than they ever did, or could have done, upon turnips and straw alone.

Again, on putting animals to grass, they uniformly go back instead of progressing, for a month at least, which is a serious drawback. It of course proceeds from the entire change of food; therefore give animals, put upon grass for the purpose of being fed, a mixture of other foods in the sheds which I have suggested, and in such quantity as to avert the scouring from the grass, and they will not only not go back, but most probably advance more rapidly; and not only this, but we shall produce a beautifully mixed meat—a thing every way desirable and valuable, but especially for preserving the market in competition with foreigners.

Make this principle distinctly understood, and imported cattle will be of no value till finished in our fields or houses, or finished abroad by *imitating* us, and brought to market with the utmost care. As I have said, I believe they cannot imitate us abroad. They want the soil necessary; and, at least, care on our part will increase the difficulty on theirs, besides improving the taste of the country.

These feeding-sheds should of course be movable, at least the upper parts of them; and as the clap-boards forming the roof (their principal part) might fold together by hinges, they might be very easily transported, as well as simple and inexpensive in the first instance. Landlords might give them, or at least the walls against which they might be erected, as appendages of the parks, and wood for their construction generally; but the last must in general cost little. I cannot, however, but think that they should be had. Our neglect or unnatural treatment of animals is at the root of much of the change that seems to be taking place in their constitutions. Must an animal not be in danger of disease in the lungs that lies with its brisket upon damp or frozen grass?—or that breathes continually the air of walls infected by previous breathing?—that has its head tied so short that its lungs must constantly rest in the same spot till they adhere?—and which of us would thrive on eternal draff and dreg? And is it not a terrible *waste*, after bringing an animal to *maturity*, and through a period of four or five years, to sell it at last as *bad meat; lean*, *unmixed*, and with horribly yellow or blackish-blue fat? There should be almost a penalty for such conduct, besides a bad market and the contempt of bad management.

And, on the whole, I would say to *landlords*, that, unless they *hasten* to do something for the climate by *sheltering*, their most valuable grain crops will speedily be of no value in the market. The produce of warmer climates will be more perfectly ripened; it in that state not only absorbs more water, (the great gain of the baker,) but it gives a better bread. Such produce will therefore be preferred: we shall lose the market for cultivation, and must return to pasture; and as pasture, *uncombined with agriculture, will scarcely be worth following, the land will become a desert and valueless.*

This has happened to countries much more minutely cultivated than this. I need only instance the Roman States; and the necessity of agriculture and its products to our system of *pasture*, (or rather of maintaining cattle, for during half the year there is no pasture,) is too obvious to require to be more than glanced at; for without agriculture we should not have sufficient food for half the year, and not the *suitable food* during any part of the year, as I have above shown.

I may be wrong, but I believe that at this moment there is not

an ingredient of our economy so valuable as *shelter*, whether for extending the products of the country, animal or vegetable, or for retaining the market for both.

In addition, it would make the country a universal garden,—

"*A scene of warmth and wealth, of verdure, fruit, and flowers.*"

And so feeling, it is no wonder that I so eagerly recur to it. Let *shelter* be combined with draining, raising steadings, &c., in the bonds accepted by Government, in the loans for improving estates.

LIVE STOCK IMPORTED, 1842-1850.

The following Table, made up from the Official Returns, shows the importation of live stock from abroad since the passing of the Act of Parliament, of date 9th July 1842, and the progressive increase which has taken place. There is also added the supply of animal food, in the shape of beef, salted and fresh; pork, salted and fresh, together with the bacon ham imported into Great Britain from foreign countries:—

Number of Cattle, Sheep, and Swine, and the Hundredweights of Beef, Pork, and Hams, imported since 9*th July* 1842.

Years.	Oxen and Bulls.	Cows.	Calves.	Sheep and Lambs.	Swine and Pigs.	Salt and Fresh Beef, Cwts.	Salt and Fresh Pork, Cwts.	Hams, Cwts.
1842	3,156	1,038	70	644	410	30,022	54,164	520
1843	1,114	368	39	210	361	60,724	27,118	448
1844	3,682	1,154	53	2,801	268	106,768	30,848	36
1845	9,743	6,503	587	15,848	1590	87,814	39,706	54
1846	17,192	25,349	2,503	91,732	3856	177,172	72,789	2,960
1847	27,831	35,480	12,406	142,720	1243	117,694	235,899	90,530
1848	24,590	22,506	15,642	130,583	2129	121,980	254,132	211,316
1849	21,885	17,920	13,646	128,569	2656	149,962	348,275	384,696
1850	26,710	20,107	19,754	143,198	7287	135,414	336,321	222,605

The duties charged are—On oxen, 20s. each; cows, 15s.; calves, 10s.; sheep, 3s.; lambs, 2s.; swine, 5s.; pigs, 2s: beef, salted, 8s. per cwt.; pork, 8s.; hams, 14s.; beef, fresh, no duty.

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 7.	41 9	27 10	20 10	24 2	25 0	26 7
14.	43 0	24 1	18 11	25 0	27 4	30 8
21.	44 2	24 11	22 9	26 6	26 11	29 11
28.	45 1	25 3	21 9	27 6	27 4	30 10
July 5.	46 2	26 0	23 0	28 6	30 0	30 0
12.	45 7	26 1	21 7	27 8	27 8	29 10
19.	45 0	25 0	21 4	28 0	30 7	29 5
26.	44 6	25 2	22 10	29 2	28 1	29 2
Aug. 2.	44 4	27 0	24 7	27 9	28 2	28 2
9.	44 10	23 0	19 6	26 10	27 5	27 11
16.	44 0	26 1	20 11	26 6	28 6	28 10
23.	43 3	28 3	20 11	25 8	26 3	26 8
30.	42 6	29 11	23 8	24 8	29 4	28 6

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.
June 4.	43 6	28 3	24 2	35 6	36 3
11.	44 10	28 5	27 0	36 6	38 0
18.	45 6	29 6	26 9	36 4	37 8
25.	44 7	28 10	26 0	35 8	37 2
July 2.	44 2	28 6	25 6	36 6	36 9
9.	43 5	28 2	24 7	36 4	37 2
16.	44 4	27 6	24 10	36 2	36 9
23.	45 1	22 9	26 3	36 2	37 0
30.	45 3	30 6	26 2	36 0	36 6
Aug. 6.	44 6	28 0	25 4	36 3	36 9
13.	43 0	24 6	25 3	36 6	37 0
20.	41 6	24 8	24 9	36 8	37 5
27.	41 10	24 10	23 10	35 6	36 2

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 7.	40 6	24 1	21 9	23 10	28 10	34 11
14.	42 5	24 6	21 2	24 1	26 8	32 7
21.	41 8	24 2	21 11	24 9	27 3	30 1
28.	43 9	25 6	21 6	24 2	29 8	35 7
July 5.	41 4	25 10	22 3	25 8	28 6	35 1
12.	42 11	26 2	22 1	26 3	28 2	34 5
19.	43 2	25 3	22 6	27 1	28 6	34 6
26.	42 9	24 9	22 10	28 0	29 3	34 11
Aug. 2.	44 2	25 6	21 6	28 2	28 4	32 5
9.	44 3	26 4	21 4	27 8	27 9	36 3
16.	42 4	24 8	22 8	27 4	27 4	33 0
23.	42 8	26 3	20 3	27 0	26 6	35 0
30.	40 0	28 1	18 1	26 6	25 8	34 3

DUBLIN.

Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bere, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour, p. barl. 9 st.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.
June 6.	23 0	14 1	9 6	13 0	13 9
13.	23 5	14 4	9 8	13 3	13 10
20.	23 6	14 6	10 0	13 6	14 0
27.	23 8	14 8	10 2	13 8	14 1
July 4.	23 10	14 10	10 4	13 10	13 11
11.	24 0	15 0	10 6	13 7	14 0
18.	23 4	14 9	10 3	13 4	13 10
25.	23 2	14 6	10 0	13 5	13 11
Aug. 1.	23 0	14 5	9 0	12 11	13 9
8.	23 2	14 8	9 7	13 0	13 9
15.	23 3	14 6	9 5	12 10	13 9
22.	23 3	14 2	9 3	12 8	13 8
29.	23 0	13 10	9 2	12 7	13 8

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vic., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 7.	39 6	38 10	24 4	24 3	20 8	19 4	23 5	24 10	26 10	26 5	30 11	29 0
14.	39 11	39 0	24 6	24 3	20 1	19 7	26 1	25 2	28 6	27 0	30 10	29 6
21.	40 7	39 4	24 4	24 3	21 4	20 1	28 0	25 9	27 6	27 3	30 5	29 11
28.	42 4	40 0	25 2	24 5	22 3	20 7	28 11	26 3	29 2	27 7	32 1	30 6
July 5.	43 5	40 10	25 2	24 7	22 5	21 1	27 6	26 9	28 10	28 0	31 8	30 11
12.	43 6	41 6	25 8	24 10	22 0	21 5	32 5	27 9	28 8	28 3	32 6	31 5
19.	42 7	42 0	25 6	25 1	21 11	21 8	28 2	28 6	28 6	28 6	31 5	31 6
26.	42 5	42 6	25 7	25 3	22 0	22 1	27 0	28 8	28 7	28 6	32 3	31 9
Aug. 2.	42 4	42 9	25 9	25 6	22 7	22 2	25 7	28 3	28 3	28 8	31 1	31 10
9.	42 3	42 9	25 11	25 7	21 7	22 1	28 5	28 2	28 1	28 6	31 4	31 9
16.	41 4	42 5	26 4	25 10	21 9	22 0	27 0	28 1	27 2	28 2	30 8	31 7
23.	39 10	41 9	26 8	26 0	20 11	21 10	27 1	27 2	25 11	27 9	31 2	31 4
30.	39 1	41 3	25 10	26 0	20 8	21 7	24 9	27 0	26 6	27 5	30 7	31 2

FOREIGN MARKETS.—Per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1851.		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
June ..	Danzig	30 0 - 38 0	13 0 - 17 6	11 0 - 14 0	19 6 - 24 0	20 0 - 24 0	21 0 - 25 0
July ..	Danzig	37 0 - 43 6	18 0 - 22 6	14 6 - 18 0	20 6 - 26 0	23 6 - 30 0	24 0 - 29 6
Aug. ..	Danzig	33 0 - 39 6	16 0 - 20 6	15 0 - 18 6	22 6 - 28 6	21 6 - 27 6	20 6 - 25 6
June ..	Hamburg	31 6 - 39 0	17 0 - 20 6	12 0 - 15 6	18 0 - 25 0	22 0 - 28 0	21 6 - 27 0
July ..	Hamburg	36 6 - 41 0	20 0 - 24 0	15 0 - 18 3	20 0 - 26 0	24 6 - 31 0	25 0 - 31 6
Aug. ..	Hamburg	32 6 - 38 0	18 0 - 21 0	16 0 - 19 0	23 6 - 30 0	23 0 - 28 0	22 0 - 27 6
June ..	Bremen	32 0 - 38 0	12 6 - 17 0	10 0 - 13 6	17 6 - 24 0	20 6 - 26 0	22 0 - 26 6
July ..	Bremen	34 6 - 40 0	14 6 - 20 0	12 6 - 18 0	18 6 - 26 0	24 0 - 29 6	23 0 - 27 6
Aug. ..	Bremen	32 6 - 37 6	15 0 - 20 0	12 0 - 17 6	19 6 - 27 0	23 6 - 28 0	22 0 - 27 0
June ..	Königsberg	30 0 - 38 0	16 0 - 20 6	11 0 - 15 6	16 6 - 24 0	19 0 - 24 0	20 0 - 25 0
July ..	Königsberg	33 6 - 40 6	17 6 - 23 9	13 6 - 17 6	18 0 - 26 6	23 0 - 28 0	23 6 - 29 0
Aug. ..	Königsberg	31 6 - 36 6	15 6 - 21 6	12 6 - 16 0	18 6 - 27 0	21 0 - 26 6	20 0 - 25 6

Freights from the Baltic, 2s. 10d. to 4s. 2d.; from the Mediterranean, 4s. 6d. to 7s. 6d.; and by steamer from Hamburg, 1s. to 1s. 3d.

THE REVENUE.—From 5th July 1850 to 5th July 1851.

	Quarters ending July 5. 1850.	Quarters ending July 5. 1851.	Increase.	Decrease.	Years ending July 5. 1850.	Years ending July 5. 1851.	Increase.	Decrease.
	£	£	£	£	£	£	£	£
Customs	4,333,703	4,318,218	..	15,490	18,740,194	18,715,072	..	25,122
Excise......	3,325,225	3,419,810	94,585	..	13,097,336	13,219,609	122,273	..
Stamps.....	1,590,767	1,525,492	..	65,275	6,325,499	6,040,249	..	285,250
Taxes	2,073,281	2,045,231	..	28,050	4,351,530	4,322,681	..	28,849
Post-Office ..	210,000	240,000	30,000	..	817,000	891,000	74,000	..
Miscellaneous	121,474	121,241	..	,233	369,744	312,333	..	57,411
Property Tax	1,026,835	976,881	..	49,954	5,459,843	5,353,425	..	106,418
Total Income	12,681,285	12,646,868	124,585	159,002	49,161,146	48,954,369	196,273	503,050
	Deduct Increase			124,585	Deduct Increase			196,273
	Decrease on the qr...			34,417	Decrease on the year			306,777

TABLES OF BUTCHER-MEAT.—Per Stone of 14 Pounds.

Date.	London. Beef.	London. Mutton.	Liverpool. Beef.	Liverpool. Mutton.	Newcastle. Beef.	Newcastle. Mutton.	Edinburgh. Beef.	Edinburgh. Mutton.	Glasgow. Beef.	Glasgow. Mutton.
1851.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
June ..	4 3 - 6 3	4 9 - 6 9	4 6 - 6 3	5 6 - 6 6	4 3 - 6 0	4 6 - 6 3	4 6 - 6 0	5 0 - 6 3	5 9 - 7 0	5 6 - 7 6
July ..	4 6 - 6 6	5 0 - 7 6	4 6 - 6 0	5 3 - 6 3	5 0 - 6 3	5 3 - 6 3	5 3 - 6 3	5 6 - 6 6	5 6 - 6 9	5 6 - 7 3
Aug. ..	4 6 - 6 3	5 0 - 6 9	4 6 - 6 0	5 6 - 7 0	4 6 - 5 6	5 0 - 6 0	5 6 - 6 6	5 9 - 6 9	5 9 - 6 9	5 9 - 7 3

PRICES OF ENGLISH AND SCOTCH WOOL.—Per Stone of 14 Pounds.

English.	s. d. s. d	Scotch.	s. d. s. d.
Merino, ...	13 0 to 17 0	Leicester Hogg, ...	11 0 to 15 6
.. in grease, ...	9 0 to 14 0	.. Ewe and Hogg, ...	9 6 to 13 0
South-Down, ...	13 0 to 16 6	Cheviot, white,..................	11 0 to 14 0
Half-Bred, ...	10 0 to 13 0	.. Laid, washed,..........	8 0 to 10 6
Leicester Hogg, ...	11 0 to 16 0	.. unwashed, ...	6 0 to 8 0
.. Ewe and Hogg, ...	8 6 to 13 6	Moor, white,.....................	6 0 to 8 0
Locks, ...	6 0 to 8 0	.. Laid, washed,..........	5 3 to 6 9
Moor, ...	5 0 to 6 6	.. unwashed, ...	5 0 to 6 0

THE IRISH LAND QUESTION.*

THE present agricultural condition of Ireland is one of deep and painful interest,—now, or never, is the time for its settlement on a solid and satisfactory basis. The storm has passed heavily over that unhappy land; her emergence from the gloom is even yet but faintly shadowed forth; we long for the dawn of a brighter day, but the darkness appears preternaturally prolonged. We seek for the explanation of this sad state of the physical and moral atmosphere, but find it so dense and full of noisome vapours that we are disposed often to believe it impenetrable, until occasionally a bright ray pierces through the surrounding fog, and discovers a spot so green and fresh as to give us hope, and tempt us to pursue our investigations. We are told that Ireland is in a transition state; that, whenever the change shall have been accomplished, she will be infinitely improved in her condition. Let us examine succinctly from what she has passed, and to what she is expected to pass.

Twenty years ago, it was stated that her chief want was the introduction of British capital and British enterprise; but capital, except in the form of mortgages on encumbered estates, was scared from her shores by agrarian murders, and British enterprise was turned to channels, no matter how distant, where life and property were more secure. Yet, in a country where there was no poor-law, no assessed taxes, light local burdens, and a protecting corn-law, a potato-fed and rapidly-increasing population, it is not wonderful that the competition for land became excessive. It was taken on any terms—long leases, short leases, no leases at all; and accordingly, from 1830 to 1840, the agriculture of Ireland was improving, and, but for her sad social state, would have progressed rapidly. High rents were paid, and widened the landlords' margin for mortgages—an opportunity of which they largely availed themselves.

From 1840 to 1850 Ireland passed through another stage. Poor-laws were introduced; the corn-laws were repealed; the famine came, and by thousands and hundreds of thousands the people perished. First, the labouring classes went down; next, the small farmers, then the strong farmers; last, the gentry. The creditors' turn has come now. Never in the history of civilised nations has any people gone through a more fiery ordeal.

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* *The Irish Land Question, with Practical Plans for an improved Land Tenure, and a new Land System.* By VINCENT SCULLY, Esq., Q.C. Dublin: Hodges & Smith, 1851.

The Tenure and Improvement of Land in Ireland considered, with reference to the relation of Landlord and Tenant, and of Tenant Right. By WILLIAM DWYER FERGUSON, and ANDREW VANCE, Esqrs., Barristers-at-Law. Dublin: G. J. Milliken, 1851.

The laws of society were with difficulty kept together; land became a drug in the market; fugitives fled from it with their own portion, as well as the landlord's share of its produce: with the opportunities of escape from them, the moral obligation of contracts was burst asunder, and the flight of the Irish tenant-farmers can only be compared to that of the Israelites from Egypt. The fearful facts of famine and flight are told in the census returns: the population of Ireland has diminished a million and a half from its amount in 1841, and two millions and a half from what in an ordinary course of prosperity it would have been: the annual rental of the country has diminished from £13,000,000 to about £9,000,000 sterling; and the selling price of the fee of land in favoured counties, from twenty-five to eighteen and fifteen years' purchase, and in counties not in high repute, from twenty to ten years' purchase, and sometimes less. It is difficult to estimate the calamity, which has been unsparing as to rank and condition. The peasant had died off; the tenant-farmer was either a pauper or an emigrant; the landed gentry were sold out in the Encumbered Estates Court.

Prior to the Protectorate, half of Connaught, by the plague and many massacres, remained almost desolate. Thither the Irish were driven on a certain day under the penalty of death; and Sir William Petty has calculated that about 580,400 of the natives perished, and were wasted in eleven years, from October 1641 to October 1652, by the sword, plague, famine, hardship, and banishment. The depopulation of the same province by the late famine and emigration must exceed that fearful aggregate of desolation.

We pause not to trace the effect that certain legislative changes may have had in rendering the sufferings of the whole agricultural community more intense; we have merely sketched an outline of the state through which Ireland has passed.

Let us now consider to what she is expected to pass. The very great re-distribution of property conveyed with an indefeasible title and freed from incumbrances, either in the shape of family charges, or in that of a superabundant pauper population, is very properly considered as the harbinger of brighter days for Ireland; and the operation of the Encumbered Estates Court, however painful the process, is expected to place the future landed interests of the country in a healthy and sound position. The whole system of property in Munster and Connaught can now be remodelled on a sound foundation, and it is to this point we turn our view, and most earnestly and urgently invite public attention.

We desire to impress upon the country that the sale of the fee, or the encumbered interest—a matter already provided for by the Legislature—does not go far enough. The relation of landlord and tenant requires, and, by the rare combination of circumstances to which we have adverted, admits of readjustment. Ireland is in

such a position that she must have not only new proprietors, but new tenant-farmers: the vast importance of placing both parties upon a clear, easily understood, and fixed footing, cannot be exaggerated.

The short deed, sealed with the seal and signed by two of Her Majesty's Commissioners for the Sale of Encumbered Estates, accompanied by a little document called an Injunction, puts the purchaser in possession of an Irish property. He takes it in all likelihood from the hands of a receiver of the Court of Chancery, unimproved and deteriorated. The tenant-farmers are few: those who were once solvent have been pauperised by the times; or if they be supposed to be able to pay, while they withhold the payment of rents, they lie in prison under what is called an Attachment for contempt of court, in not paying this rent. Those who linger on are willing to be bought out by the price of a passage to America. The purchaser then has no serious impediment in his way, and has the advantage of a fertile soil and cheap labour. It is therefore confidently anticipated that there needs but a skilful reconstruction of the social agricultural fabric to make the whole face of the country flourish and prosper. There is hope for Ireland if their critical state of things be turned to that advantage of which it is eminently and obviously susceptible.

Parliamentary committees have inquired into the state of the relation of landlord and tenant, and have accumulated masses of unmeaning evidence. But they have not discovered a panacea for the diseased state of that relationship; they have been met by the difficulty of established and ever-increasing evils. By the agency of Providence, and, it may be, of man too, much of the difficulty has disappeared. A state of things which, five years ago, could not have been anticipated, has baffled all human calculation or foresight:

> "Furne quoad optanti Divûm promittere nemo
> Auderet, volvenda dies en attulit ultro."

Never, in our experience of the subject, has there appeared to us a more fitting time, or a more precious opportunity, for the aid of legislation in removing the obstacles which have hitherto impeded, by legal restraints, the progress of agricultural improvement in Ireland, and in making the existing law of landlord and tenant clear and intelligible. We have an insolvent code of law, a criminal code of law, a bankrupt's code of law, the advantages of which are admitted and daily experienced; whilst we have permitted the laws of landlord and tenant to become so complex, so obscure, so incongruous and cumbrous, that, whilst they hold out bounties to evasion, they restrict beyond all reasonable limits the power of contract between man and man. We are not censors of our forefathers, and of our own generation, for the state of confusion to which they and we have reduced this branch of the Irish

law,—a perusal of it shows that they have been desirous from time to time to apply remedies for existing evils.

Thus, to stimulate the tenant to improve his farm, it was necessary to confer on owners having but limited interests leasing powers. Hence the statute-book abounds with leasing powers to tenants for life, tenants in tail, bishops, beneficed clergymen, corporations (clerical and lay,) commissioners of idiots and lunatics; whilst, with a whimsical inconsistency, nearly all these powers vary not only as to farming, but to every kind of lease for mines, mills, fisheries, buildings. It is stated that there are thirty-four statutes relating to the leasing powers of ecclesiastical corporations; six relating to infants, lunatics, and married women; and twelve to tenants for life and in tail—making a total of fifty statutes upon this one subject.

Upon this point, though we thereby anticipate our general observations on the valuable work of the authors, we quote from Messrs Ferguson and Vance.

The nature of the proprietor's leasing power must have considerable influence in facilitating or impeding improvements, for although the small farmer may be indifferent to the possession of a lease, yet few men of capital will embark it without having it secured to them by a suitable tenure; and many instances occur in which, if the proprietor had a power of giving a sufficient term, capital would have been expended most beneficially to the neighbourhood. A case, mentioned by Professor Hancock in his valuable statistical papers, will illustrate this more clearly than we can do. He says, "A capitalist in the north of Ireland, anxious to introduce a flax-mill in a poor and populous district, adjacent to a turf-bog, required, in all, fifty acres for the mill site, labourers' village, and his residence, and fifty acres of bog. The owner, being tenant for life, gladly offered him all the land he required, at a nominal rent, for the longest term he could grant, and to renew every year during his life; but this was found impracticable, as he could only lease for thirty-one years, (or only three acres for the mill site in perpetuity,) and his leasing power required the reservation of the improved rent on every renewal, so that on the building of the mill the rent should be increased. The mill was consequently not built; and twenty miles distant, the flax-spinner found land on which he could get a perpetuity interest, and expended his capital in building and machinery, and has since given employment to hundreds of labourers, while the poor and populous district is still poorer, and more populous—not through the ignorance or perverseness of disposition, but the defective leasing power of the proprietor. The flax-spinner knew his business; the landlord opposed no shortsighted selfishness to the arrangement; the law alone was the impediment. All parties were injured: the poor deprived of employment in building, spinning, and cutting turf; the landlord suffered from the poverty of his tenants, preventing the increase of his rent; the mill-owner had to use English and Scotch coal, instead of Irish turf. It is therefore vain to teach the people that turf is cheaper than coals, if the law will not let mills be built in turf-bogs."

We are, therefore, led to conclude that the question of leasing powers is one that imperatively demands the attention of Parliament. The number and variety of enactments on this subject render it impossible for any unprofessional person to ascertain the extent of his dominion over his property. Valuable improvements are often made on the faith of leases, which are found afterwards not to have been warranted by the particular Act of Parliament under which they profess to have been granted; and many proprietors, anxious to improve their properties, are ignorant of the means provided for them by the Legislature. The simple remedy for this state of things would appear to be, to consolidate into one general act so many of the provisions on this subject at present scattered over the statute-book, as experience may have proved to be beneficial to the community; to repeal such of them as are unsuited to the present condition of the people, and to enact in their stead such provisions as

the wisdom of the Legislature may devise; to give greater uniformity to leasing powers; to regard less the person of the owner exercising the power, and to regard more the object for which that power should be conferred—the improvement of the soil, and the welfare of the community; and to recognise the principle that, if a certain class of land requires any given term of years to be conferred on the occupier, to encourage him in its reclamation or improvement, the leasing power should not fall short of that period, in whosoever's hands it may be vested; and that it shall not be one year's power in the hands of a rector, twenty-one years' in the hands of a bishop, thirty-one years' in the hands of a tenant for life, and forty-one years' in the hands of a tenant in tail—due precaution being taken to prevent the partial owner securing to himself any undue advantage, at the expense of those who may be his successors in estate.

But the evil is not confined to the mere diversity of leasing powers: to obviate the mischief of limiting the period to which tenants for life, and persons bound by settlement, were restricted, has long been attempted by the insertion in settlements and family deeds of powers to the persons possessed of partial interests to grant leases for periods longer than those allowed by the law. But, though the design was excellent, the object has not been satisfactorily attained. There has always been an impediment, arising from the uncertainty which attaches to all leases made under leasing powers, either from want of title in the party granting the lease, or the omission in the observance of some technical formalities, which, according to the strict construction of courts of law, have been held to vitiate or render void the lease, though both the contracting parties had acted upon and considered the instrument binding.

It would appear that in Scotland, where the laws of entail have been more stringent than in either England or Ireland, the statutable leasing powers have been more liberal, "every proprietor of an entailed estate having, by the provisions of the 19th Geo. III., c. 51, notwithstanding the most strict entail as regards the granting of leases, the power of making farming leases, for the purposes of encouraging agriculture, for thirty-one years, at the old rent, and building leases on certain conditions; and by a later statute, (6 & 7 Will. IV. c. 42,) being enabled to lease lands for twenty-one years, at a fair rent, notwithstanding its being diminished from the old rent, and building leases for ninety-nine years. These have been still more enlarged by the provisions of the 11 & 12 Vict., c. 36, which have given very extensive powers of leasing to heirs of entail." The practical evils in Ireland, to agriculture, from the complex state of the law in this particular, are obvious, and force themselves continually upon every person connected with land or law. The remedy suggested by the writers from whom we have last quoted appears very simple—to pass one law with respect to leases, the powers conferred to be uniform: for example, all farm leases to have the same duration; and so with respect to building and other leases. But before we enter into more details, let us first dispose of the more general consideration of the subject.

It is not to be wondered at, nor deprecated, that, in a country whose staple is agriculture, and whose agricultural relations are so defective and of so much diversity, the land question should be discussed; the wonder rather is, that the remedy has not been earlier attempted. The consideration of this subject, like many others in Ireland, has been characterised too much by wild and impracticable views, too often started by extravagant or interested parties. If the difficulty arises from the state of the law, it is gratifying to find that its professors investigate the subject with sobriety of thought, moderation of view, and absence of prejudice. The first path of safety comes from an unexpected quarter. As lawyers are generally disposed to fight under the banner of the old English barons—*nolumus leges Angliæ mutari*—we are gratified to find that men of established legal reputation have undertaken the direction of the necessary reform in this branch of the law. The views of the learned gentlemen whom we are about to notice differ widely. As we have the misfortune to disagree with Mr Scully, we propose to consider his work first. It is pleasant to get over opposing views, before we enter upon the comparatively easy task of expressing acquiescence.

Mr Scully's work is principally valuable as the composition of an intelligent and dispassionate gentleman upon a subject deeply affecting agriculture, rather than as suggestive of *practical* views. They have, however, the charm of novelty; and the style is neat and succinct, without being meagre, and always perspicuous and intelligible. The author is an extensive land-proprietor, and also one of her Majesty's counsel. He is deeply interested in the question, and has the advantage of bringing professional knowledge to its consideration. Nevertheless, his views are not a little startling. Impressed with a conviction of the complicated intricacies and evils of the present land system, he prefers revolution to reform: in other words, he proposes the adoption of an entirely new land system, and the creation of a land tribunal; and gives the following outline of his plan, "showing the mode of its creation, its intended privileges and advantages, and the machinery by which it may be constituted and continued." He proposes—1, As a matter of voluntary arrangement between owner and occupier, that they should, by a written proposal, agree to have their land brought under the operation of a new tribunal, to be called the Land Tribunal. 2, The land tribunal to have a map prepared, and a valuation made, of the land. 3, The tribunal to deposit in their registry-office their map of the land, with a judicial declaration of its fair letting value, the names of the owner and occupying tenant, and the nature of their respective interests; the lease and necessary evidences of the title to be also deposited. 4, The effects of such deposits—"to bring the lands under the operation of the improved land tenure, to be for ever afterwards

held according to that tenure, with its several new incidents;" amongst which he enumerates, summary power to the landlord, in case the rent agreed upon shall not have been lodged in bank to the credit of the land tribunal on or before the gale-day fixed for its payment, to resume immediate possession of the land, on obtaining a certificate of the non-payment of rent, "but with liberty for the tenant, within six months, either to redeem his interest, upon paying up the rent, with all expenses and costs, or to sell his interest to any third party:" power to the landlord "to raise money, on security of land debentures, to an extent not exceeding ten years' purchase of the fixed rent; the amount so borrowed to be lodged to the credit of the land tribunal, and to be applied, either for the landlord's own purposes, or in payment of any charges affecting the land;" the tenant to have "a perpetual interest, so long as he may continue to pay the rent agreed upon: power to the tenant to fine down his rent, at a specified rate, such as four per cent, or twenty-five years' purchase:" power to the tenant, "who may have paid one moiety of the sum required to purchase the absolute ownership, to raise the remaining moiety upon the security of land debentures." There are additional privileges, which Mr Scully does not consider essential to the organisation of the system, but which he thinks might be usefully annexed. He proposes that the governing body shall be called a Land Tribunal, and he gives the following outline of its duties:—

"1, To prepare appropriate forms, and make general rules, in order to regulate the course of proceedings; those forms and rules to be approved of by the Privy Council, and afterwards laid before Parliament, in a manner similar to the general rules made by the commissioners under the Irish Encumbered Estates Act. 2, To receive and examine each proposal; to have a map made of the land, and ascertain its fair letting value; to investigate the title, and to require that all documents, which may be necessary for bringing the land under the operation of the improved land tenure, shall be duly lodged in the registry-office. 3, To receive and pay over all rents; to receive and duly apply all sums paid for the purpose of fining down any rents; to act summarily in enforcing punctual payment of rents, and in compelling the observance of all fair covenants. 4, To issue land debentures in the proper forms, and to receive and duly apply all payments made on account of the principal or interest. 5, To examine any application of the registered tenant for the absolute sale of any settled or trust estate; to assent to such absolute sale, in case it shall be shown to be for the benefit of the parties interested in the property; to receive the purchase-money for any settled or trust estate, and to provide for the future application or investment of the purchase-money, and of the annual interests and profits,

according to the legal rights, and so as to protect the interests of all parties. 6, To arrange for having local land banks or offices established, through which all receipts and payments shall pass, in connection with any land held under the improved land tenure, on account of the reserved rent, or of the land debentures, or of any purchase-money for the land."

The author would reduce the means of encumbering the interest of owner or occupier to a single mode—that of land debentures, to be transferable from hand to hand, and negotiable in the same way as bills of exchange and promissory notes, extending the principle of the bill introduced the session before last by Sir John Romilly. Mr Scully sanguinely anticipates, from the operation of his scheme, nine direct and twenty-five indirect benefits. These are, (as regards the landlord,) punctuality in payment of rent, with cheap and summary powers to enforce it; the prevention of waste of the land, and increased security to him, according as the rent may be fined down or purchased off by the tenant. As regards the tenant, to him is given the power of purchasing the fee in the farm, or fining down the rent, and of selling his interest. To both parties the scheme proposes the facility of disposing of their interest in the land by a simple process, and the privilege of raising money at low interest by means of land debentures. Money would become as plenty as blackberries at Michaelmas: "land companies, land debenture companies, land investment companies, mutual land societies, and land banks, would spring up on all sides." Mr Scully also imagines a vivid picture of the indirect *blessings* that will flow from the adoption of the improved system of land tenure, of which these are the smiling features—economy and industry will characterise the farmers; labour will be in full demand; the moor and the mountain will be reclaimed; each occupier will be enabled to maintain his family in comfort; poor-rates will not only diminish, but disappear, "like mists which portend the day more clear;" "the poor-house will be emptied, and their innocent prisoners be released from those jails for the unemployed;" emigration will cease; "the Irishman will have an interest to defend the soil of Ireland against all foreign comers—he will no longer feel as an alien in the land of his birth; the men of Ireland will become the faithful friends and free defenders of the empire, instead of remaining its hereditary helots and natural foes; and the troops which garrison Ireland may be withdrawn;" absentee ownership will cease to be an evil, and its machinery of middlemen and his subordinates will disappear; while, as the result of many other co-operating influences, "the wealth of all classes will be multiplied manifold, and Ireland will become a better customer for the manufactures of Britain."

The advantages which are thus imaginatively foreshadowed, on a much more subdued scale might, indeed, and we hope *will*, fol-

low from a good practical land system; but we *demur* to their being deducible from that proposed by Mr Scully, and we believe that no portion of the landed community is prepared to adopt so vast a change for so problematical a good. The institution of a new court invested with very extensive jurisdiction, which would supersede the established legal institutions of the country, is a step that the generality of reflecting men would pause at before they sanctioned. The gentry of Ireland would require to see their way clearly before they submitted to a novel jurisdiction with unlimited powers; and the prospectus here submitted offers no sufficient inducement. We think they would oppose, *in limine*, a compulsory valuation at which their lands are thenceforth and for ever to remain.

There are very serious difficulties in the way of a public or semi-public valuation. On this point Messrs Ferguson and Vance observe—" Everybody observes with astonishment, when the value of land becomes the subject of legal controversy, how utterly discordant the evidence of even the fairest and most intelligent surveyors and valuators is as to the value of land: one man will fix a value three or four times as great as another, so that the conclusion to which every bystander is of necessity led is, that the result depends on the accident of the person chosen as umpire." Under the Poor-Law Act, " a specific standard of value was laid down for the valuators, yet neither the valuators making the valuation, nor the guardians revising it, paid the least attention to the prescribed standard; and, instead of adopting the market and letting value of the land, arbitrarily assumed as their standard the amount of burden which a landlord, in their opinion, was morally justified in imposing on the tenant: so much for the faith that is to be placed in a valuation by authority, when it is to affect the relative rights of landlord and tenant, even though made by men acting under no strong motives to decide corruptly." To show " what a wild thing a valuation of rents by public valuation would be, the case of Bennett *v.* the Duke of Bedford is referred to. His Grace had let a farm of 350 acres to a tenant at £270 a-year, and an umpire awarded as compensation the sum of £6351, 11s. 4d. against the noble landlord," (p. 357.) The prudent way is to allow the contracting parties to determine for themselves the value of the commodity they are dealing for. Independently of the practical objections, there is a grave one on principle to Mr Scully's plan—the effect of investing the tenant with a perpetual interest at a fixed rent, accompanied with a power of gradually purchasing the fee in a bit and bit way of one year's rent at a time, (utterly useless to the landlord,) would be another mode of reintroducing the middleman system into Ireland; for as the tenant would have the power of assigning his interest at an increased rent, two rents would be thus at once carried out; and this system might be car-

ried by descending gradations, until the occupying tenant and the head landlord became separated by many removes. Now, we conceive this middleman system to have been mischievous in the extreme to Ireland, and any approximation to it should be sedulously avoided. It appears to us that it would be more for the public good that the fee-simple should rest as a distinct essence, if we may so speak, in one class, and the power of hiring out the *usufruct* in the soil in another, for a definite period, at the expiration of which it should revert to the owner in fee, the rights of occupancy being always kept distinct from the rights of property. Under Mr Scully's system, several interests in perpetuity might be created, with the evils consequent upon a rack-rent at the base, a small chief rent at the top, and the intermediate interests so subdivided that in no one individual would there be vested the substantial ownership of the soil.

The bait thrown to the landlord of summary ejectment in case of non-payment of rent is not substantial, and could be proximately, if not altogether, attained by an improvement in the present law of ejectment, which, though a partial change for the better has taken place by an act of the last Session, we admit to be notoriously defective.

In a commercial country like ours, the more pliant that lands can be made in the hands of the owners the better; and if facilities for sale be afforded, it is, we conceive, equally politic and just to invest the proprietor and farmer with equal facilities for the lesser rights of borrowing. Whether the mode be by land debentures or otherwise is immaterial, if the object be attained. We should not limit the owner or farmer to one mode of borrowing; on the contrary, we should make land as flexible in their hands as possible, and allow them to pledge or sell it in any way, or to any extent that may best suit the complicated arrangements of our old social system. This power might, no doubt, be abused; but in the main it would be more beneficial to the individual and the community than the cramped and shackled privilege of borrowing in one stereotyped public form, and to a restricted amount.

The work of Messrs Ferguson and Vance has more significance than may at first sight appear. Though a very careful and elaborate performance of 450 octavo pages, it had been prepared for private circulation only, but is now offered to the public over the counter. It is dedicated to Lord Monteagle, and derives its existence from a request of Mr Napier, the Member for the University of Dublin, with the view, we presume, that at least a portion of the intelligent community who have at heart the welfare of the agricultural interest of Ireland should have a practical acquaintance with the state of the law of landlord and tenant in that part of the United Kingdom, and the differences which exist between it and the analogous laws of Great Britain.

It is not to be supposed that so extensive and laborious an inquiry could have been consummated without a view to ulterior and practical results; and we hazard the conjecture that Mr Napier, if the Government do not take up the subject, will introduce a measure for the improvement of the law of landlord and tenant. He has already had the merit of carrying an improved bankrupt law through Parliament, and has reduced into one intelligible code the laws affecting the glebes of ecclesiastical residences in Ireland. We know no Irishman who, from his legal attainments and position in the House of Commons, is better adapted to the useful labours we have assigned to him; and for the accomplishment of this object, the work of Messrs Ferguson and Vance forms a most useful pioneer.

After a careful and dispassionate investigation of the subject, the writers express their conviction, that "while the existing law contains much that is good, it is, on the whole, in an unsatisfactory state; that the time has arrived when the legislature may safely interfere to consolidate and simplify it, and remedy such defects and inaptitudes as time, and the changes and character of the relation, and the progress of civilisation, and the improvements in agricultural science may have developed; and that, although the suggestions of the Parliamentary commissioners have resulted in many important changes in the law, there are yet more difficult and equally essential parts of the subject remaining unsettled, which, after the hopes and expectations that these very inquiries have raised, cannot now be suffered to remain undisposed of, without consequences more serious than deep disappointment." We entirely concur with them in this view, and think that the active efforts of all practical men should be turned to the improvement of the existing, rather than the introduction of a new, landlord and tenant law. The opportunity, from the causes to which we have already adverted, is evidently favourable for the purpose. The Legislature is not chargeable with want of attention to this very important subject; they have been rather over careful than the reverse. Thus, in the reign of George III. no less than sixty acts were passed for Ireland on the law of landlord and tenant, whilst but six were enacted in the same interval for England.

The subject has been one of great difficulty. The relation began in feudal times, and had many feudal incidents; but as the country became more commercial the necessities of commerce produced a relaxation of feudal obligations; and, the new being often inartificially blended with the old system, there has been a patchwork legislation. Besides, the accumulated statutes of centuries (in addition to the judge-made law) require revision and arrangement. The subject is also widely extended, and we have to thank Messrs Ferguson & Vance for their *resumé*—we had almost written *exposé*—of the law.

It is not within our limits to enter into an investigation of the many important questions they have brought under our notice, more especially with respect to the law of ejectment and distress; but we cannot pass over one of the most discussed and most practical questions of the day—that of tenant's compensation for improvements.

This subject presents a very different aspect when viewed with respect to Great Britain and to Ireland. In the former, a tenant enters into possession of a farm fully equipped with farm-houses and offices; he receives his land in a proper state for routine cultivation, and is under no necessity of expending money to repair dilapidations, and put his farm into working condition. In Ireland it has hitherto been, is now, and for some time will be, widely different. The tenant-farmer receives the raw material —land and nothing more; he has to build, fence, and drain. The increased value of the soil is due to his capital and skill; when his lease expires he gives up an improved and *manufactured* article in place of the raw. To whom should these improvements belong? The law has decided that they belong to the landlord, the effect of which has been found injurious to the community, as the progress of improvement has been thereby checked. No man sows that another man may reap: every farmer will echo Burns's sentiment, "D—l take the like of reaping the fruits that another must eat." In England the law may safely be left as it is, for the improvements are the products of the landlord's capital, or a matter of contract, with the tenant standing on equal terms and at arm's length. But in Ireland the past generation of landlords had (generally) no capital; and the Irish tenantry were, from the competition for the commodity, obliged to take land without contracting for the benefit of their improvements. Accordingly these were either undone—or, if done, defectively executed—and a source of contest between the parties at the termination of the lease. Even in cases where both parties were desirous to enter into equitable arrangements with respect to improvements, the family settlement of the landlord presented an insuperable barrier to his granting a sufficiently long lease to the tenant to remunerate him for his necessary outlay. Undoubtedly this cause materially depressed the agricultural condition of Ireland, and is still in operation, for, where the Encumbered Estates Court has not changed the proprietary, family settlements exist as before; and where it has, the purchaser can hardly be expected to have a double capital—one to purchase the fee-simple, another to improve it when bought. It is to be considered that the purchasers, who have frequently been pre-existing encumbrancers, and have bought in self-defence, are dealing with properties which, as far as farm-houses are concerned, are utterly waste. The permanent improvement of the land, the erection of dwellings, &c., must be made by

another class—that of the tenant-farmer; and hence, in the present desolate condition of Ireland, the importance of placing the law on a satisfactory basis, and one that will offer inducements to improve.

There are, no doubt, exceptionable cases, in which the landlord makes the improvements. For example, Lord Lucan has studded ten thousand acres with farm-buildings, and has farmed that tract with admirable skill and energy; but a few isolated cases do not disprove our general argument.

We do not enter into the peculiarity of tenure of tenant rights in parts of Ulster. Our authors show its practical working to be this—that it is impossible for any man to take land who is not possessed of capital to purchase the tenant right. For example, the landlord is entitled to a pound an acre, the tenant claims £8 an acre for his tenant right; thus, on a farm of 800 acres, the purchaser must pay £800 for the possession, and by this means exhaust the capital which should be applied to the due cultivation of the soil. This simple statement is sufficient to demonstrate the inexpediency of the extension of this custom to other parts of Ireland. It is open to nearly all the objections we have stated to Mr Scully's plan of giving the tenant perpetuity of tenure. Messrs Ferguson and Vance have shown that the claim of tenant right does not rest on immemorial custom, nor on the ground of its being in compensation of *bona fide* improvements. As to the first point, there are men alive who remember when the custom was not in existence; and as to the second, it is acted upon in cases where the tenant has not improved at all. The claim for compensation for improvements is fully discussed by the authors. The difference that exists between the laws of Scotland and Ireland deserves to be noted:—

By the law of Scotland, the landlord is bound, without express stipulation, to deliver the farm and offices to the tenant in a state suitable for the working of the farm, the dwelling-house fit for the occupation of the tenant and his family, the stable and byres fit for the reception of the cattle, and the barns for his grain; and if, through decay occasioned by lapse of time, without undue negligence, they fall into disrepair, they must be rebuilt by the landlord; and the tenant is entitled to be remunerated if he spontaneously undertakes to effect such improvements as are absolutely necessary. But if the tenant incur expenses or improvements which are not absolutely necessary, however useful or valuable, as in the erection of fences or other similar operations, he is supposed to have executed such improvements solely in contemplation of the immediate benefit which might thereby accrue to him during the period of his possession, and the currency of his lease, and has no claim for compensation at the expiration of his tenancy; although, if it should come to some abrupt or premature conclusion—for example, for some defect in the lease, the tenant is entitled to a proportion of the value of the meliorations. But the tenant very frequently undertakes repairs and meliorations under an express stipulation that he shall be allowed to claim from the landlord a certain sum, fixed by valuation, at the end of the term, and regulated by a scale depending on the length of the unexpired period of the lease. These stipulations are binding, not only on the proprietor and his heirs, but also on his successors in the estate, where it happens to be entailed, and on purchasers, where the property has been substantially benefited. It is also competent to the landlord, if he pays the compensation, to charge the amount on the estate against his successors, as

a personal debt due to himself. In some parts of Scotland it is the custom for the landlord to grant his obligation or bond to the tenant, to refund the value of the improvements at the expiration of the lease; and the incoming tenant usually pays the value of the meliorations to the outgoing tenant, and receives from the landlord a renewal of the obligation in his own favour; and by a repetition of these transactions the tenant in possession has, not unfrequently, a greater interest in the property than the landlord himself.

The writers have come to the conclusion—

If we were to regard this question merely as a landlord-and-tenant question, and upon strict principles of right and wrong, and apart from other and public considerations, we should be disposed to say that this plan of improving a man out of his own estate, against his will, was a measure incompatible with justice; and that, if this thing is to be attempted at all, it must be on broader grounds, and on faster claims than tenants' right to compensation for the improvement of another man's estate; that it must not be dealt with as a landlord-and-tenant question, or placed upon the footing of an adjustment of rights or redress of grievances, but on the basis of an imperious necessity, such as to overrule the private rights and interests of individuals for the benefit of the community.

The farmers will not be disposed to discuss the ethics of the question, if they find that the writers go with them practically, and would reverse the rule of law that gives the landlord the benefit of all improvements, and would promise, in the absence of contract, that the landlord should be presumed to have assented to allow the tenant to reap a fair profit from his improvements, either by enjoying them or by being paid for them.

The question, then, which remains to be considered is—What are the improvements for which a tenant should be compensated?—and amongst these the authors enumerate fixtures, farm-buildings, farm-yards, fences, drainage, clearance of rocks and stones, subsoiling, marling, chalking, and claying the soil, which are obviously improvements more or less permanent in their nature. Now the existing law gives to the landlord all fixtures, though, if the contract were made with a trader, and for trade purposes, the latter would be entitled to them. This distinction between trader and farmer, so unfavourable to the latter, should be abolished. The difficulties of carrying out the details of a good tenant-compensation bill are undoubtedly great. The authors suggest that the machinery in Ireland for recompensing tenants who plant timber should be adopted as a *model*. The *modus operandi*, in this case, is registering in the office of the Clerk of the Peace of Petty Sessions the number of trees planted; in like manner, permanent improvements on a farm might be registered. They suggest that the determination of the value, at the end of the tenancy, should be left to the same tribunal which tries the amount of trespass cases, libel, slander, compensation for roads, &c.—a sheriff with a jury on the spot.

We have risen from the perusal of this work with a profound conviction on our minds, that the subject treated therein is one of incalculable importance to the future prosperity of Ireland. We

cannot withhold from our readers the following eloquent description of the unhappy state of Ireland:—

We do not profess to believe that any mere extension of leasing powers, or encouragement of improvements, can extricate the landed interest in Ireland from the difficulties with which they are struggling almost without hope—that it can restore life and energy to the wasted frame of society, or bring back the active and energetic people that have deserted the desolate and wild districts of the south and west, once teeming with a hardy population, to expend their energies on distant and more fortunate regions. We do not think it can retrieve the ruin of our country gentry—no doubt, in many instances, occasioned by their own or their ancestors' past improvidence, but accelerated and enormously aggravated by the sudden depreciation in the value of agricultural produce, which no foresight on their part could have anticipated, and the contemporaneous increase of the burdens on land, the appropriation of its entire annual produce, till production, proving useless to the producer, has ceased; and now, the fee-simple value of the fee-simple estate alone remains to be sacrificed to meet the cruel demands of imports, that, having consumed and annihilated the vital functions and reproductive powers of the system, now prey upon the inanimate frame they have deprived of life. We do not hope that it can redeem the bankruptcy of the small farmers and the country shopkeepers, which those best acquainted with the country seem to think is enlarging its sphere daily, and involving in a universal ruin and destruction the whole population of Ireland, notwithstanding the delusive cry, that the pressure was but temporary, that the symptoms of regeneration were appearing, that the traffic of the railway companies was developing itself, and the number of paupers diminishing. Those who have looked more closely, and perhaps more disinterestedly into the subject, can see that whole counties are becoming desolate wastes; that the aristocracy, magistracy, and gentry, are descending steadily, and disappearing fast; their estates, the provisions of their families and their creditors, are being sold at eight or nine years' purchase, which thirty years ago might have brought twenty to twenty-five years' purchase; that the railway traffic of the south and west is chiefly swelled with the tide of emigration, carrying away the bone and sinew of the country, everything of skill, and strength, and capital, and enterprise, that pestilence and famine had left us, leaving behind the old, the infirm, and the idle, to stock our workhouses. We know that mere legislation upon this point cannot reach evils so extensive and deep-seated; but these considerations suffice to show that any course of legislation which has a tendency to promote employment, to develop the resources of the land, to encourage the outlay of capital, and to render life and property more secure, should at least command the serious attention of Parliament. We would not compel men to make contracts: to permit or facilitate the making of them is another thing, and fairly within the province of wise legislation. If tenants for life, and many other persons, at present incapacitated by law, should be empowered to make certain defined contracts binding on the inheritance, and proper precautions were adopted to prevent fraud and collusion, the impulse that might be given to employment in Ireland would, we anticipate, be such as to remove, in the course of time, many a weak-grounded cause of complaint, and to effect more for the peace and prosperity of the country than ever has been or ever can be done by the accumulated mass of modern Acts of Parliament. In short the case of Ireland is urgent, delay is dangerous, the time for trying a new policy favourable; and may we venture to predict that the statesman who has the courage to attempt it will certainly succeed!

We shall not prolong our remarks, important though the subject be, nor weaken the force of the foregoing observations, which have great force in themselves, by any diluting matter of our own.

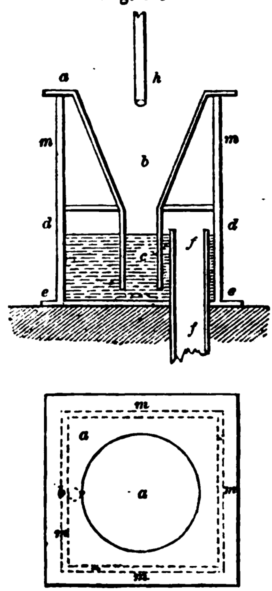
AGRICULTURAL ARCHITECTURE AND ENGINEERING.—No. III.

By R. S. Burn, M.E., Mem. S.A., Author of "Practical Ventilation," &c.

(*Continued from* p. 165.)

We finished our last paper with a description of what may be called a composite structure, embracing in one the advantages of a water-closet, liquid-manure tank, with flushing cistern; we now, in concluding this portion of the subject, notice a cheap and easily-constructed modification of the "pottery water-closet" alluded to in page 163. The following sectional sketch, fig. 31, will give an idea of the principle of this contrivance: it will be seen that there is little possibility of its getting out of repair, that it may be easily set in any closet, and that, so long as a supply of flushing water is kept up, and the communication with the drain perfect, no smell can arise. The modification of Mr Ridgway's more ornamental form may be made by any village joiner or carpenter. The sketch is drawn to a scale of three-fourths of an inch to a foot, and shows the plan and section. The conical or upper part *b* should be lined with lead or gutta percha, as well as the trap-box *d d*, and pipe *c*. Where the exit pipe *f f* joins the drain, care should be taken to make the joint perfect; *m m m m* is the framework; *a a* is the seat, *h* the pipe leading from the flushing cistern, *b* the conical upper part lined with non-absorbent material—the lower part of which should be joined water-tight to the eduction pipe *c*; *d d* is a water-tight box, on which the whole rests, and serves as a trap; the pipe *f f*, communicating with the drain, reaches near the top, with the eduction pipe *c* near the bottom of this box: there is therefore no place for the escape of the foul air from the drain into the apartment in which the box is placed. It is evident that this contrivance is well adapted for any situation, all that is requisite being a communication with the drain and the flushing cistern; it may be placed in its position in a few minutes, being fastened to the floor by the projections at *e e*. The external covering may be made ornamental, if required.

Fig. 31.



SCALE ¾ INCH TO 1 FOOT.

As a cognate branch of this department of our subject, we may here notice those contrivances now adopted in the most improved

constructions, for the convenience of hand-washing, &c., in bed-rooms and sculleries. Those introduced by Ridgway, and termed the "pottery fountain hand-basins," are very cheap, and even elegant in design. The following sectional sketch, fig. 32, will convey an idea of this "convenience:" *a* is the pipe leading from the rain-water cistern; *b b* the basin, supplied with a plug which fits into the top of the pipe at *c*, thus retaining the water at pleasure: this plug should be attached by a chain to the side of the basin, to prevent its being lost; *d d* the pipe leading to the drain by the exit *e;* and it should be trapped at the junction. This form is adapted to cases where the supply of water can be obtained from a cistern above the level of the basin. In cases where there is no provision of this nature, another form is required; at least, a subsidiary contrivance has to be adopted to supply the defect, which is attained by having a small pottery cistern hung at a short distance above the basin, where it is filled with water when required; and the water is withdrawn by means of a small stop-crane. In places where the communication with the drain cannot be effected, another form of hand-basin is adopted, having the pedestal hole, in which is received the used water, and from which it is withdrawn by means of a stop-crane. Where the pottery hand-basins are not available, simple modifications may be adopted as in the following sketches, which are drawn to a scale of three-fourths of an inch to the foot. Fig. 33 is the form for the constant supply, and fig. 36 that for cases where this is not available. In fig. 33, *a* and *a* is the supply-pipe from the cistern, *b* and *b b* the hand-basin, which, if made of the form as shown, will be cheaper than if spherical. It should be lined with gutta percha, if not of pottery ware. *c c* and *c* the eduction-pipe, furnished with a plug; *d d* the trap-box; *e* the pipe leading to the drain. The basin may be made octagonal, hexagonal, or of the form in the sketch. By having a flat side, it can be placed right against the wall, and save room.

Fig. 32.

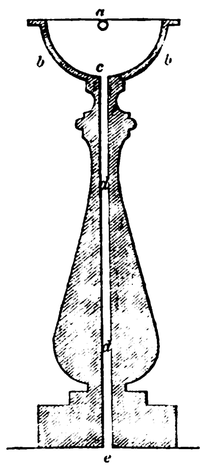
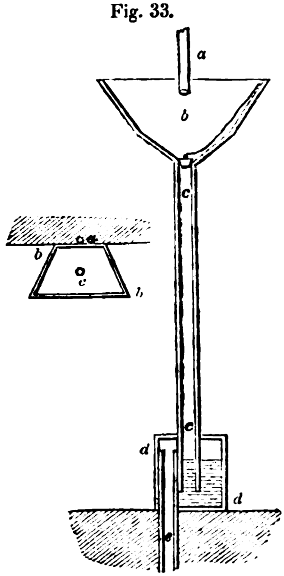


Fig. 33.



SCALE, ¾ INCH TO 1 FOOT.

In figs. 34 and 35 we have given sketches which may serve as hints in designing a cover or external case, by means of which the whole apparatus may assume an ornamental form, a desideratum worth the labour of effecting. In fig. 36, a modification adapted for a special cistern is shown: *a* is a box or small cistern, hung so as to be easily removable; above the basin *c*, *b* is the supply-pipe, reaching to within an inch or two of the basin, furnished with a stop-crane; the eduction-pipe *e e* communicates with a box *d d*, which serves to hold the used water till withdrawn by means of the stop-crane: the eduction-pipe *e e* should reach nearly to the bottom of the box, so as to prevent any smell arising from the box, in case the water should be allowed to remain too long therein. The basin and apparatus connected therewith may either be fastened firmly to the wall by holdfasts, or supported by uprights, as *g g*. In all cases it is requisite that the box *d d* should be at least 12 inches from the floor, in order to admit a vessel below the stop-crane, by which to convey away from time to time the used water. In fig. 37 we have given a slight hint for an ornamental cover for the supply-cistern or water-box. The contrivances we have thus far explained, although simple, and, as some may think, trifling in their nature, will be found not only conducive to health and comfort, but also to the carrying out of that "prudent method of life," which looks upon the economy of time as equally important with that of money. In thus indicating these simple contrivances, we are endeavouring to assist, though but slightly, those enlightened men who, knowing well the truth of the adage, "that the

Fig. 34.

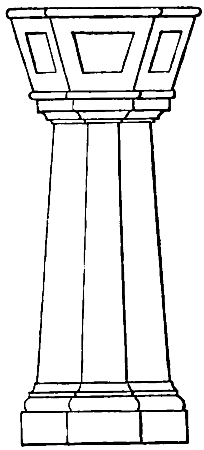


Fig. 35.

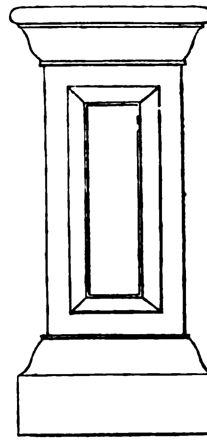


Fig. 36.

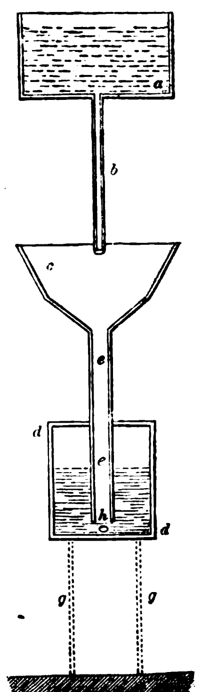
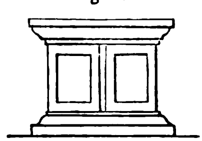


Fig. 37.

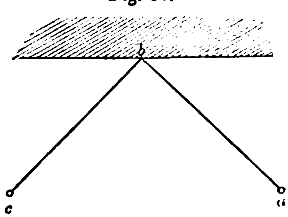


aggregate of the happiness and comfort of a community is made up of a multitude of units," are endeavouring to attract attention to that system which hopes for wider-spread health and comfort, by giving due consideration to those contrivances, hitherto looked upon as altogether trifling in their nature, but which certainly form the basis of an improved social system.

Before proceeding to the consideration of the arrangement of dwelling-places, so as to give the greatest possible amount of comfort with the least outlay, we shall give a few hints on a very important matter—namely, the construction of fireplaces. It is much to be regretted that so little attention has been paid to this department of house construction—the proper method of constructing and fitting up of fireplaces and grates is one which demands, and should obtain, the consideration of the man of science, and not left to the hap-hazard dictates of the ignorant or presuming. "This, in a country where the prepossession in favour of the cheerful open fireplace is so strong—as it is ever likely to remain in England—is a subject of the greatest importance; and it is lamentable to see how its cheerfulness is often diminished, and what ought to have been a glowing comfort changed into a smoky nuisance, owing to the want of proper knowledge on the part of those who make, and those who fix, the grates and appendages of the hearth." Let us note very briefly the requisites for obtaining the utmost amount of heat from the least quantity of fuel; and, in order to have clear ideas upon this, it will be necessary to understand the following particulars. Heat, as obtained by the combustion of coals in a grate, consists of two kinds—"radiant" and "combined." As we have remarked elsewhere, "radiant heat is diffused through the air at an immense velocity, without materially raising its temperature, but immediately warming solid bodies exposed to its influence, its effect being increased in proportion to the number of points which a body presents to its influence; hence it is more rapid in rough surfaces than in smooth ones. The sun, fire, candles, gas, all give out radiant heat. In an apartment warmed by an open fire, the heat thrown out raises the temperature of surrounding bodies, which, in turn, give out the acquired heat slowly. High temperature is required in bodies ere they can throw off much radiant heat; the redder the fire in an open fireplace, the warmer is the radiant heat: it follows, then, that bodies at a low temperature, *i. e.* below 212°, afford very little heat from radiation. Radiant heat is unequal in its effects—some part of the body may be overwarmed by it, whilst others may be cold; moreover, it can only be used on a small scale. If large fires be kept up to raise the temperature of the room, the heat near them is too great, diminishing as the square of the distance to positive inefficacy. The attendant disadvantages of a number of fires are too obvious to be more particularly indicated." The

combined heat is that which passes off from the fire in the shape of heated air and smoke, and also that "conducted" or led off by the surrounding materials, of which the grate or fireplace is composed. The radiant heat of a fireplace is that chiefly available for warming the room; and it bears a small proportion—estimated at one-third—to the combined, which in nine cases out of ten is altogether lost. Radiant heat being chiefly derivable from red-hot surfaces, the greater the amount of red clear-burning fuel presented to the room, the more heat will be obtained. Metallic bodies are quick conductors of heat, and serve, when much used about grates, to rob the fire of a certain amount of available, and otherwise useful, heat; hence, the less metal used the better, and the rule that brick and other non-conducting material should, in all cases where adaptable, be alone used. Rays of heat in a fireplace are reflected from the surrounding surfaces, in accordance with well-known laws; scientific men have studied these, and have deduced simple rules, by following which, the rays of heat from a fire, instead of being reflected in directions — useless, so far as the heating of the room is concerned — are sent, in the proper course, to fulfil their destined purpose. Suppose a ball to be projected from a schoolboy's hand directly against a wall, it will rebound from it and return to the hand that threw it; but suppose it is made to strike the wall at an angle, the ball will no longer return to the expectant youth, but will glance off in a direction contrary to the line of its first impulse, but the angle at which it leaves will be equal to the angle at which it struck the wall. The law governing the motion of the ball is expressed by learned men thus, "the angle of incidence is equal to the angle of reflection"—that is, the angle of the line at which the body *c*, fig. 38, leaves the wall *b*, is equal to that at which it strikes it from *a*. This law also governs the movements of the rays of heat. Thus, they are reflected from the surrounding surfaces of a fireplace, in directions dependent on their form. It is easy to demonstrate the difference of economical effect obtained from a certain quantity of fuel, consumed in two fireplaces, one of which is constructed with surrounding surfaces disposed according to the laws of science, and the other formed by the arbitrary rules of usage. An old writer has clearly shown this in the following diagrams and explanations:—"Supposing the fire F *f*, fig. 39, in a common chimney, whose sides or jambs A B and *b a* are parallel to each other, the ray of heat *f g* will be reflected to *m*; the ray *f h* upon itself into *f*; the ray *f k* into *n*, and the ray *f l* into *p*; and as the ray *f l*,

Fig. 38.



going from *f* to *l*, constantly rises—as it does also when, after reflection, it goes from *l* to *p*—it must get within the flue before it reaches *p*; and then, whenever it strikes against the forepart of the funnel, which is inclined to the horizon, it will be reflected upwards into the chimney, always supposing the angle of incidence to be equal to that of reflection, and therefore it cannot go into the room." The loss, therefore, attendant upon having a fireplace with the sides at right angles to the back is thus demonstrated; and yet grates, in such a form, can be counted by thousands in a moderately-sized town. The advantages of having the surrounding surfaces accurately disposed are thus demonstrated: "Geometry teaches us that all rays which, coming from the focus of a parabolic curve, strike upon its sides after reflection, go on parallel to the axis. If, therefore, on the back part of the hearth of the chimney (fireplace) A B and *b a*, fig. 40, the length C *c* be taken, equal to the length of the wood to be burnt—as, for example, 22 inches, and from the points *b* and *c*, the perpendicular C D and *c d* be drawn for the axes of two half parabolas, whose vertices shall be at C and *c*, and the distance of the breadth of the chimney be two points of the said parabolas, then, if those parabolic jambs A C and *ca* be covered with plate-iron, brass, or copper, and the smaller part of the chimney-piece be made parallel to the horizon, and as broad as may be, leaving only 10 or 12 inches for the passage into the funnel; this chimney will not only reflect a great deal more heat than common chimneys, but as much heat as any chimney *possibly can do;* for if F *f* be the two foci of the half parabolas, when the billets (or extent of fuel) are on fire, the rays of heat darted from the said foci F *f*, which in common chimneys cannot go into the room, and so are useless, will here be reflected parallel to the axis *c d* to *m n o p*, and consequently go into the room. If the rays which come from any part of the fire between the foci of the parabolas

Fig. 39.

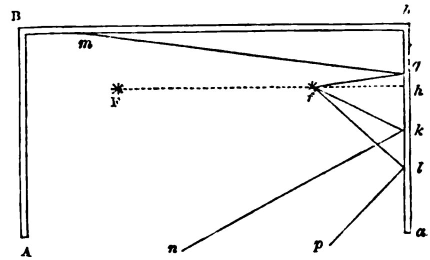
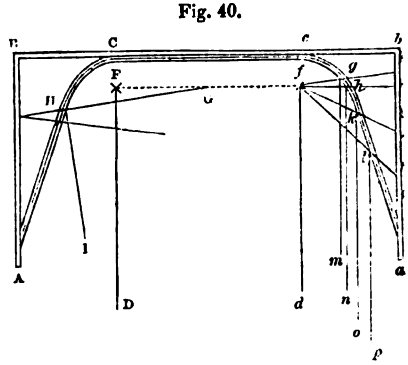
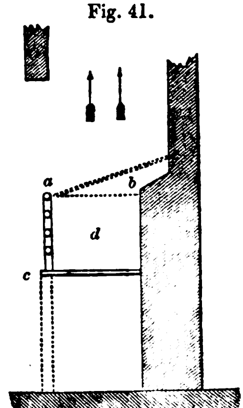


Fig. 40.



be examined, it will appear that, though they are not reflected from the jambs in such a manner as to go parallel to the axis C D, *c d*, yet they will all be reflected into the room as G, H, I." Let us apply these facts now elucidated to practical construction. The redder the burning fuel in a grate, the more radiant heat; the more, then, of red surface we can *present* to the room the better; and how this is to be obtained?—Not, certainly, by adopting a huge cubical or box-like grate, as long as it is deep, and nearly as wide, because such a plan seems to us the very best that can be adopted, where the chief aim is to consume as much fuel as possible, so as to give out the least possible quantity of useful heat. There are two kinds of fireplaces in use—one for cooking as well as warming; the other chiefly for warming. Let us note their distinguishing features. In the first, two kinds of heating surfaces are required: first, "horizontal," or that presented by what is called the "top of the fire," and is used for boiling and other kindred purposes; the second is "vertical," or that presented by the depth of the burning fuel, or what is known as the "front or bars of the fire," and is available for roasting, toasting, &c. In the sitting-room grate, it is obvious that only one kind of heating surface is wholly available—that is, the "vertical," or front; the horizontal chiefly passes its heat up the chimney—especially if the grate is placed far from the floor—unless, indeed, the fuel is made to slope from the front bar towards the back, when a species of mongrel surface is produced, three-fourths of the heat of which is lost. Let us trace the matter still farther; the lesson we derive from this will amply repay the trouble of acquiring it. In the "box grate," as we may call it, a diagram illustrative of which we give in fig. 41, we have the two kinds of heating surfaces requisite in a cooking grate amply developed—horizontal, as *a b*, and vertical, as *a c*; but at what cost are these obtained?—Why, at the expenditure of a mass of fuel contained within the space of *d*, nine-tenths of which are allowed to burn in absolute waste. Apply this to a sitting-room, you have good, efficient, room-warming heat from the vertical surface *a c*, but nearly all from *a b* passes up the chimney, as indicated by the arrows. Slope your fuel as in the dotted lines *a* to *e*, you not only literally but metaphorically add "fuel to the fire," for you increase the surface for waste, and obtain little corresponding advantage. Note, then, how a knowledge of the true source of heat from a common fire enables us to obviate unnecessary waste. A glance at fig. 42 will show how this is effected: ample vertical

Fig. 41.



with horizontal space, and the internal ineffective portion reduced to a minimum; equal heating surfaces with half the fuel—all this by merely sloping the back of the grate. This is no chimerical plan, but one which has been adopted with signal success, and which deserves to be more extensively known. For a sitting-room grate the rule is this — extend the depth and front, and reduce the width from front to back as much as possible, leaving room enough for proper combustion of the fuel. In fact, so efficient is this plan that an eminent engineer has remarked, that if we could have merely a thin stratum of red-hot fuel (like a plate of half-inch red-hot iron) placed in front of our grates, we should have as much heat as when burning a huge heap of coals in as huge a box. When grates and chimneys are constructed so as to be really useful, we shall see small coals burnt in small receptacles—not quantities sufficient to drive a two-horse steam-engine used to heat a room a few feet square. For a large kitchen-grate, the proportions as follows were found to be efficient: the breadth *a b*, fig. 43, from side to side, being 14 inches, the depth from top to bottom bars, inclusive, 10 inches; the width at fig. 44, from inside of top bar to back of grate, 6 inches; that at bottom, as of 4 inches. This was pronounced a highly-effective and economical fireplace. We may here mention that M. Soyer, the prince of modern cooks, is an advocate of this form of construction. So much for the form of the grate; let us now consider its situation. And here we discard the system of placing the grate high up—little, in fact, below the chimney-breast—as altogether absurd and wasteful. Ignorance, or rather disinclination for patient inquiry, doubtless originated the idea and usage; that hindrance to improvement has perpetuated it even to this our day of crystal palaces and boasted civilisation.

Fig. 42.

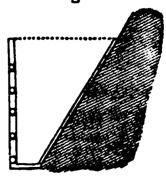
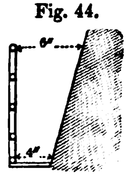


Fig. 43.

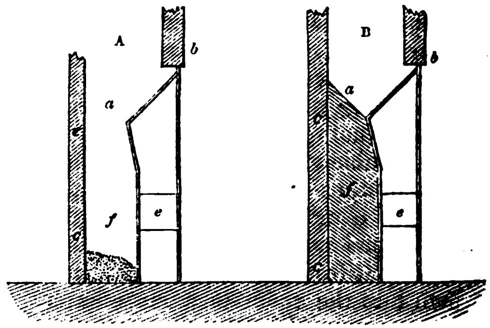
Fig. 44.



The lower we place the fire to the floor the better; and the more heating effect will be obtained where the grate is used for warming (not cooking) alone. By placing the grate near the floor, a double effect is obtained: the floor, in the first instance, is heated, thus warming the currents of air which usually flow along and over it from all parts of the room to the fireplace, and which ascend upwards to the room, communicating heat; but the rays of heat from the horizontal surface, or "top of the fire," are thrown into the room to a large extent, instead of flying up the chimney, as would be the case were the grate placed near its opening. Instead of placing the grate far back within the jambs, thus

throwing a large portion of the heat on their middle surfaces, it should be placed so that the front bars will be flush with the outside of the jambs. In the majority of instances, grates are now bought ready for fitting up: in accordance with improved and correct principles, these are made comparatively narrow from front to back; this advantage, however, gives rise very frequently to a disadvantage—that is, the recess made for the reception of the grate is so deep, that when it is fixed properly, a large empty space is left behind it. This is a source of danger: on this point we quote some hints we have elsewhere given. "The practice of making the recesses for the reception of grates deeper than absolutely necessary, should be at once condemned. The form of grates almost invariably used is that known as the 'register,' or similar construction. These, when placed in their receptacles, leave a large empty space between the back and the wall: this often, in nine cases out of ten, having direct communication with the flue above, serves the purpose of a deposit for all falling soot, which accumulates until it reaches that part of the back of the grate which is apt to be—in fact, is—generally highly heated, and combustion ensues. It may be objected that the backs of grates are, in some cases, made of fire-brick, and that, consequently, the heat is not sufficient to cause ignition. Admitting the fact, the inference may be denied: it takes a much lower degree of heat to ignite so combustible a matter as soot than is generally supposed, and the result of all experience proves that this is the case. Again, sparks may be carried up the chimney, and fall down amongst the soot; but all objections to an unlimited condemnation of the practice of leaving spaces behind grates are but poor and lame excuses for not getting rid of the absurdity. The use of a flue is to carry off the created soot, and that of a fireplace to heat the room; it is, therefore, as unphilosophical in principle as inducive of danger in practice, to allow spaces to be left for the reception of that which has no right to be there, or to construct grates in such a manner as to make it a *possibility* that inflammable substances near them may be ignited. Fig. 45 will illustrate the proper form of construction of the recess which should be provided in apartments for the placing of the grates. A shows the method too much in general use for old

Fig. 45.



chimneys; *c c* is the back wall; *b* the wall of the apartment; *e* the grate; *f* the receptacle behind, having free communication with the flue *a*. B shows the plan recommended: *c c* is the back-wall; *e* the grate, closely placed in contact with the brick-work *f*, the shape of which should be that of the back of the grate; *a* the flue, and *b* the wall of the apartment.

We have now to detail the best methods of making the surrounding surfaces of the fireplace. The form having the sides at right angles to the back, as in fig. 39, may be looked upon as the very worst that can be adopted; and the parabolic in fig. 40 as the best. This form of curve may, however, be deemed difficult to make; that introduced by Count Rumford must therefore be adopted: it is shown in fig. 46, the sides *a c* and *b d* being at an angle of 135° to the back *a b*. A method of laying this expeditiously out may be useful; the following is Mr Hood's plan: "The sides are a right angle of 90° A B C, fig. 47, and the bars *d e* describe a quadrant of a circle, whose radius is just half the length of the side A B. If we now wish to follow Rumford's rule of making the back one-third the width of the front, we obtain this by taking one-third of the length A B, which will give B*f*; and then, if we draw the line *fg*, we shall obtain exactly the required dimensions. By this arrangement it will be perceived that the sides of the stove form an angle of 135° with the back; and all the rays of heat which fall upon the sloping sides will therefore be reflected into the room, directly in front of the stove, in right lines." This form has been characterised as the "best possible plan for diffusing heat into the room." The object of constructing proper sides and backs to grates being the throwing of *radiant* heat into the room, it is of importance to decide upon the best material of which to form these. Of all which may be used for this purpose, iron is the very worst; it is a good conductor, and, unless highly polished, a bad reflector—two attributes not at all useful in this case. The desideratum is a material which is a bad or slow conductor, and a good or quick reflector. Bricks will answer the first condition, and, if whitened, the

Fig. 46.

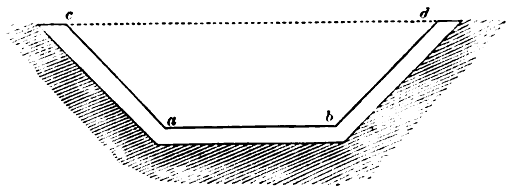
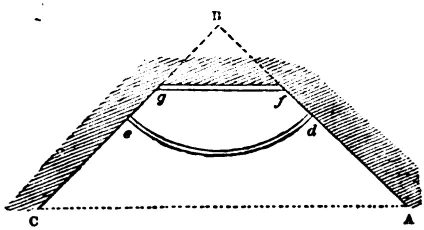


Fig. 47.



second also, to a certain extent. The ordinary methods of whitening will not, for obvious reasons, do; the highly-glazed pottery-ware will, if a white or cream colour, answer admirably. In the use of this material for lining fireplaces, we hope we are returning to the old method; and if properly arranged and manufactured—not daubed over with unmeaning artistic attempts in sepulchral blue or flaming red—the sooner the better, for the sake of economical warming of our rooms. In constructing fireplaces, the opening should be arched at top; if left flat, the chimney-bearer should be of iron, never of wood: bearers of the latter material have been the cause of many accidents by fire. The entrance to the chimney-flue should be directly above the fire; the smoke should be carried off as quickly as possible. This may be objected to by some, as only resulting in carrying off the *heated* air too quickly. This objection, however, only holds where the chimney is made wide enough to serve (as is too often the case) for a twenty-horse steam-engine, not calculated for the quantity of fuel usefully consumed in a kitchen or sitting-room grate. Wherever the chimney is proportionally constructed, the sooner the smoke leaves the fire the more economical will the results be. Our reasons for this will be shown when we give the remarks on chimneys. In order to throw as much of the heat as possible into the room, the dome, or upper covering of the fireplace, should be made sloping. Thus, in place of having an open flue, as from *a*, fig. 48, allowing the heated air and rays at once to pass off, make a sloping dome, as shown by the dotted lines *b b*—an aperture of proper size being left in it to admit the egress of the smoke. This dome should be at an angle of 135° with the back *b c*. It will best be made of brick, and built with pottery-ware. From the nature of this surface, a large amount of the heat-rays will be thrown into the room, which, if the opening into the flue was left open, would be projected up the chimney, and lost. Fig. 49 shows the passage of the smoke, by the arrows, through the opening in the dome *b*, from the surface of the fire *a*, in the grate *c*.

Fig. 48.

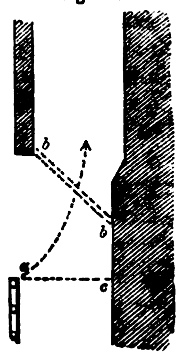
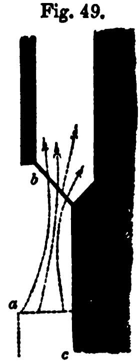


Fig. 49.

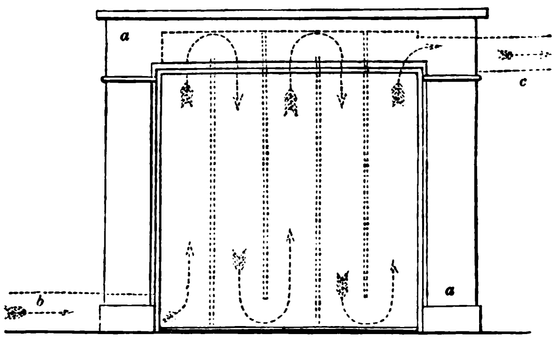


Whatever be the nature of the materials used in the construction of grates and fireplaces, it is obvious that a large amount of heat will be conducted from the fire by their agency. If iron is largely used, the conducted heat will bear a considerable proportion to the whole amount produced by the fire. If brick is mostly, and iron, on the contrary, sparingly adopted, the loss will not be so obvious; yet, nevertheless, it will

be so considerable that it is worth the labour of the true economist to devise some method by which the heat so conducted may be made available for heating purposes. By the aid of a few remarks, and one or two diagrams, we will be able, we hope, to show how this may be done.

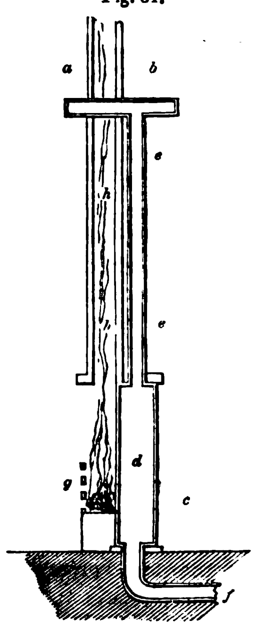
The materials surrounding every fireplace are more or less heated, thus affording means for obtaining a certain amount of warm air. The following figure is an example of a plan introduced by the old writer we have already quoted, and is remarkable as affording an example of an invention far before the opinions of its day, and which we, even in this the time of practical science, are far behind. Suppose

Fig. 50.



a a, fig. 50, to represent the front elevation of a fireplace, at the back of which is an iron box closed at both ends, and divided in the direction of its length into compartments by alternate partitions, as shown by the dotted lines—a pipe *b* communicates at the lower end with one of the partitions, and cold air passes through it from the external air: the air thus admitted passes up the compartment, round the partition in the direction of the arrows, till it finally reaches the last division, and passes through a pipe *c* communicating with the interior of the room. It is evident that, so long as the fire is kept upon the hearth, so long will the box be heated, and the air passing along it raised in temperature by the use of simple means. The flow of air may be regulated so as to supply any amount of warm air desirable. The plan shown above is designed for a wood fire; in the following figure we give a modification of the plan adapted for coal. This has been introduced into labourers' cottages by Sir William Monteath, Bart. Three rooms derive heat from one fire, over and above the apartment in which the fire is placed. Fig. 51

Fig. 51.



represents a section; *g* is the ordinary fireplace; at the back of which is an iron box *d*, which is supplied with cold air from the outside by means of the pipe *f*; the air, as it is heated in *d*, ascends by the pipe *e e* into a box placed beneath the flooring of the rooms above: a grating opens into each room, *a* and *b*, through which the warmed air enters. Clothing may be dried near the side *c* of the box *d*. Fig. 52 shows the plan; *g* is the fireplace, *d* the heating-box. In this modification, it is obvious that the box *d*, being made of iron, may become overheated, and burn the air passing through it, thus rendering it unwholesome; moreover, the material being such a good conductor, it may rob the fire of much of its heat. Altogether, we conceive that, by such alterations as follows, considerable improvement will result—by making the side of the box nearest the fire a nonconductor, by lining it with bricks, and putting alternate partitions, as in fig. 50, in the box *d*: this will enable the air to derive more heat by being retained in the box for a longer time than if the divisions were absent. Instead of having a separate pipe *e e*, fig. 51, to conduct the warm air to the rooms above, let the side of the flue *h h* form *one* side of the pipe *e e*, the other nearest the room being, as before, of iron; the smoke and heated air passing up the flue will communicate a portion of their heat to the air within *e e*, which will be a certain addition to the amount of warm air admitted to the rooms *a* and *b*. It will be seen, however, that this plan is only available where one fire is used to heat two rooms, both being dependent on the constant maintenance of this fire: from this arrangement much inconvenience may arise. It is always better to have all domestic arrangements in one apartment perfectly independent of those in another. We offer the following as affording some hints by which the fireplace of each separate room may be constructed so as to give out the fullest amount of its available heat. The object in this modification is to furnish a large amount of air moderately warmed, rather than a small quantity heated to a considerable degree; hence the heating chamber behind the grate is made entirely of brick, the alternate partitions only being made of iron. In figs. 53 and 54, we have given diagrams illustrative of the plan we propose. The fireplace is at *b b*, fig. 53; at the back of this a space is made 9 inches wide, and as high as the grate, and

Fig. 52.

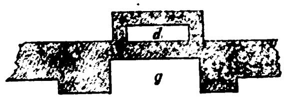
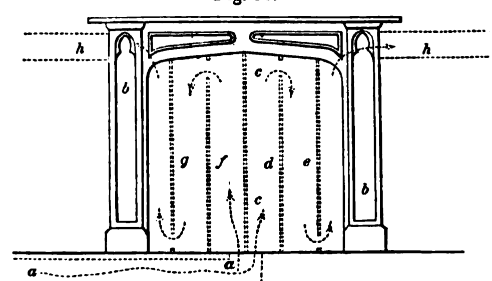


Fig. 53.



of corresponding width with the fireplace. In the centre of this a partition of plate-iron is placed, reaching towithin 4 inches of the top of the chamber, thus dividing the heating chamber into two partitions of equal dimensions—the orifice of the cold-air pipe *a a*, leading from the external atmosphere, is placed beneath the central partition *c c*, so that the air passes equally up into the two divisions. Each division is provided with two partitions *d e*, *f g*, making in each three compartments; at the top of the last of these, the pipes *h h*, leading to the wall on each side of the fireplace, convey the warmed air to the apartment. Fig. 54 is a vertical section, showing the arrangement in another point of view: *a* is the grate; *b b* the brick partition at the back of it; *c c* the wall; *h* the heating-chamber; *d* the cold-air pipe, and *e* that leading to the apartment. A simple valve for regulating the quantity of warmed air admitted to the room may be made thus: suppose the orifice of the warm-air flue to be 6 inches diameter, procure two plates of strong tin or polished brass, *a* and *b*, fig. 55; in each of these make any number of apertures, exactly corresponding in shape, number, and position; fix one of these, as *b*, in the orifice of the pipe *e*. Having previously made an aperture in the centre *c* of both plates, procure a handle with a pin; pass it through the plate *a* and fasten it; this is passed through the aperture in the centre of the plate *b*: by turning the handle *d*, the plate *a a* will be moved round, thus presenting the apertures in such positions that at one time the solid part of one plate shall be opposite the apertures of the other, thus preventing all egress of the air through the pipe *e*: when the apertures on both plates *a a* and *b b* coincide, there will be free admission of the warm air to the apartment. It is evident that, by this means, any amount of opening and closing of the apertures may be effected. With regard to the advantages obtained from the use of these plans we have thus indicated, of deriving the full heating effect of common fireplaces, we offer the following remarks by a competent authority:—" The external air, in passing through the caliducts, (compartments in the heating chamber,) being raised to a temperate heat, and spreading itself throughout the chamber, a person in the coldest weather is surrounded with warm air, and heated, without going near the fire,

Fig. 54.

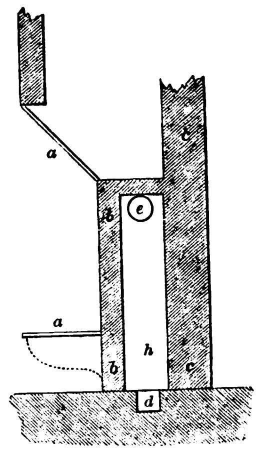
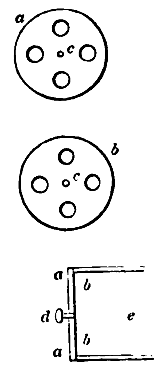


Fig. 55.



on all sides at once; while, from the construction of the hearth, he enjoys the radiant heat in greater perfection than in the common chimneys. The large body of air, constantly flowing into the room from the caliducts, prevents all *chink-winds* or dangerous disease-bringing currents; and as there is as much impure air withdrawn as there is fresh warm air admitted, an unceasing salutary ventilation goes on, from the time the fire is lighted until it is extinguished; so that a person may always remain in a room thus warmed, and breath as pure an air as if he were in the fields."

THE FARMERS' NOTE-BOOK.—NO. XXXIV.

Experiments with Hunter's Hopeton Wheat. By Mr HAY of Whiterigg, Roxburghshire.—The following experiments were conducted with the view of testing the dibbling and broadcast thin-seeding of wheat; and it will be seen that the seed used was from $\frac{3}{4}$ of a bushel up to $2\frac{3}{4}$ bushels per acre. These quantities were sown at different periods, and under almost every variety of succession.

Last year the experiments were conducted under somewhat different circumstances; the portions of ground, although worked and seeded in different ways, were all in the same field, and manured in the same manner.

The fields were six in number, and all of them of stiff clay, with retentive subsoil, the north-exposed ones being of better soil than those with a south exposure. Three of the fields were divided, the crops on them being treated in special ways—or rather the ground on which the crop was raised having been treated in a different manner from the other portion of the field.

It will be seen from the Table of results that the dibbled portions keep well up this year; and I am now of opinion, if wheat be early sown, that thin-seeding is more profitable than thick, independent altogether of the saving which is effected on the seed. And I prefer the dibbling to the broadcast sowing, as it is much better done, and the air is freely admitted to each stalk, by means of the rows; and besides, the land may, as it ought to be, be hand or horse hoed, which process, I am perfectly satisfied, increases the produce, though in my case hoeing was not attempted.

We are, as yet, far back in this district as regards improved implements; and it will be a time before we employ corn-dibbling or ribbing machines, which must, of course, go in advance of the corn-scufflers. A feeling, however, against the old wasteful expenditure of seed is arising; and many are now finding that half the quantity of seed formerly sown produces as good crops as they were wont to have under the old quantities.

The first field in the table is *South Swanstons*, which was divided into three portions, being fallow. It was properly worked

and cleaned during the summer, and one portion was well manured with Edinburgh street-dung; the other portions having a good dose of farmyard manure. All these portions, after the manure was ploughed in, were ribbed-up for the seed. On the 31st of August, one of the portions, dunged with farmyard manure, was dibbled on the top of the ribs with Newington's hand-dibble, sowing about $\frac{3}{4}$ of a bushel on the acre. I stated at the end of my paper last year, that I had then two acres dibbled with 1 bushel, $4\frac{1}{2}$ tenths—which is rather more than $\frac{3}{4}$ of a bushel per acre—and that the expense per acre was 7s. 9d. for seed and labour. It was this portion of fallow-land I have mentioned above.

The other portions of the field, manured with the common dung and Edinburgh street-manure, were sown broadcast by hand, at the rate of 1 bushel per acre, and harrowed and water-furrowed in the ordinary way, the dibbled portion requiring no additional water-furrowing. These portions were not sown till the 20th of September; but it will be seen, by referring to the Table, that the crop grown upon the Edinburgh manure was cut on the 26th of August; while the dibbled and the broadcast, upon common dung, were not cut till the 1st September. A quarter of an acre of each was measured off, cut, weighed, and dressed; and the results showed the dunged broadcast to have the greatest produce, the dibbled next, and the Edinburgh manured crop decidedly inferior to either.

	Straw and Grain.		
	Stones.	Bush.	Tenths.
Common dung, broadcast, per acre, . .	456	37	6
... dibbled, . . .	384	31	6
Edinburgh dung, broadcast, . . .	344	29	6

The next field is *North Scots*, which was sown on the 14th October with $1\frac{1}{2}$ bushel of seed per acre. The previous crop was tares, which had been well manured; and the wheat was also manured with common dung, the land ribbed-up, and the seed sown broadcast by the hand. The crop was cut on the 10th September; and although the number of bushels was not awanting, the weight per bushel was very low—in fact, the lowest weight of any of the lots.

	Straw and Grain.		
	Stones.	Bush.	Tenths.
Common dung, broadcast, per acre, . .	328	31	2

In this, as in all the other lots, $\frac{1}{4}$ of an acre was the portion of ground measured off and tested.

North-East Field had been strongly manured with Edinburgh street-manure, and with 2 cwts. each of guano and gypsum, for potatoes and turnips. The potatoes were early lifted; and after the land had been grubbed with Scoular's grubber, it was ribbed-up, and wheat dibbled upon the ribs, with $\frac{3}{4}$ of a bushel per acre,

on the 27th September. One-half of the seed was old pickled wheat, which had been left over from sowing the fallow-land; the other half was new seed. A very heavy dash of rain came on immediately after the land was dibbled, and much of the new wheat perished in the ground; indeed, so bad was it that I often had it in contemplation to sow it over again. However, it stood, and part of it, and part of the other, were measured and tested; and notwithstanding their miserable appearance, the yield was not far amiss. The heads of the wheat were the longest I think I ever saw.

The turnips, being a good crop, were got off when the ground was dry; and after being ploughed, was ribbed-up, and the seed, 1½ bushel per acre, sown upon it, on the 29th October. It will be seen by the Table that, though there was a month of difference in the time of sowing, they were both reaped on the same day; and though the weight per bushel was the same, there was a deficiency of 7 bushels two-tenths in the dibbled.

The ribbed, in this case, must not be taken as if it were a full crop; for, looking at it on the ground previous to cutting, we did not expect half a crop; and our surprise is at the greatness of the gift. The results are—

	Straw and Grain. Stones.	Bush.	Tenths.
Turnip land, broadcast, per acre, . .	384	36	—
Potato land, dibbled, ...	360	28	8

North Bickets.—The preceding crop was turnips also, manured with common dung, (a full dose,) with 2 cwts. each of guano and gypsum. The land, after the turnips had been lifted, was ploughed and ribbed-up, and sown on the 7th November with 2 bushels of wheat, and the crop reaped on the 20th September, two days previous to that on the last field; which is contrary to what took place on the fallow-land, when the Edinburgh manured land was the first ripe. This field and the last mentioned (*North-East*) are adjoining, and the soil is of the same character. The result in this case is, however, less of produce in grain, though exactly the same in weight of straw and grain:—

	Straw and Grain. Stones.	Bush.	Tenths.
Turnip land, broadcast, per acre, . .	384	32	4

South Bruntons.—This field had lain two years in grass; and as the soil was better fitted for wheat than oats, and being desirous of trying wheat under the circumstances, 2¾ bushels per acre were sown broadcast on it on the 28th December, when the land was in a dry state, and suited for the purpose; and it will be seen that, although so late of being sown, it was ripe for cutting about the same time as the turnip wheat. The yield of it, however, was very small, both in straw and grain, and in number of bushels,

which no longer makes it a question with me as to the impropriety of attempting such a crop under like circumstances.

	Straw and Grain. Stones.	Bush.	Tenths.
After lea, broadcast, per acre, . . .	296	26	8

The last field which I have now to mention is *South Bickets*, which had been young grass after oats. A considerable portion of it was kept for cutting for the horses and cattle; the rest of the field was pastured with sheep up to the 1st June, then allowed to stand for hay, which was cut; and as soon as the crop was lifted, sheep were again put upon it, and retained until the land was ploughed, when it was sown with $2\frac{3}{4}$ bushels of seed per acre on the 13th February. The portion kept for cutting was cut three times, having been top-dressed with guano and gypsum previous to the first cutting, as also after the first and second cuttings. It was ploughed with the rest of the field, and sown with the same quantity of seed per acre, on the same day. There is a great difference in the produce, not so much in the straw and grain, as in the number of bushels per acre, which the crop after the cut grass gives over the pastured foggage, or aftermath. The straw of the grain, after the cut grass, was of a much richer colour than was that of the other; and this was perceptible as soon as the wheat began to change its colour, and it maintained its superior appearance in every respect. The results in this field were—

	Straw and Grain. Stones.	Bush.	Tenths.
After hay, broadcast, per acre, . .	352	29	6
After cut grass, broadcast, . . .	360	34	—

Having given these statements with regard to the management of wheat under ten different aspects, I shall leave the reader to consider for himself, in his own circumstances, under which of these aspects he would be inclined to cultivate his wheat crop; and, at the same time, he may take into consideration whether, on a stiff clay soil, in an inland district, at an altitude of about four hundred and fifty feet above the sea-level, it be advisable to risk a turnip crop, with the view of sowing wheat after it, rather than to bare-fallow the land, with the probability of having the wheat sown at a much earlier and better season.

[Table

TABLE OF RESULTS OF EXPERIMENTS WITH HUNTER'S HOPETON WHEAT.

NAMES OF FIELDS SOWN WITH HUNTER'S HOPETON WHEAT. — Autumn 1850, Spring 1851.	Prior crop	How sown.	Quantity of seed sown per acre.	When sown.	When reaped.	Number of sheaves on a quarter of an acre.	Weight of straw and grain on a quarter of an acre.	When led-in to the barn.	When thrashed and dressed.	Produce of good grain from a quarter of an acre.	Produce of light grain from a quarter of an acre.	Weight per bushel of good grain.	Weight of straw and grain per imperial acre.	Produce of good grain per imperial acre.	Leaving weight of straw and refuse per imperial acre.
			bush.				stones			bu. 10ths	10ths	lb	stones	bu. 10ths	stones
South Swanstons, .	Fallow	Dibbled	0¾	Aug. 31	Sept. 1	94	96	Sept. 9	Sept. 10	7 9	0½	58½	384	31 6	253
Do. do.	Do.	Broadcast	1	Sept. 20	Aug. 26	100	86	Sept. 3	Sept. 4	7 4	0¼	57½	344	29 6	224
Do. do.	Do.	Do.	1	Sept. 20	Sept. 1	107	114	Sept. 9	Sept. 10	9 4	1	58	456	37 6	299
North Scots, . . .	After tares	Do.	1½	Oct. 14	Sept. 10	100	82	Sept. 19	Sept. 19	7 8	1	55½	328	31 2	204
North East, . . .	After potatoes	Dibbled	0¾	Sept. 27	Sept. 22	100	90	Oct. 3	Oct. 7	7 2	1½	56½	360	28 8	241
Do. do.	After turnips	Broadcast	1½	Oct. 9	Sept. 22	100	106	Oct. 3	Oct. 7	9 0	2	56½	384	36 0	277
North Bickets, . .	Do.	Do.	2	Nov. 7	Sept. 20	91	96	Oct. 3	Oct. 7	8 1	2	56½	384	32 4	258
South Bruntons, . .	After lea	Do.	2¾	Dec. 28	Sept. 23	116	74	Oct. 3	Oct. 10	6 7	1½	58½	296	26 8	172
South Bickets, . .	After hay	Do.	2¾	Feb. 13	Oct. 6	104	88	Oct. 13	Oct. 15	7 4	2	57	352	29 6	228
Do. do.	After cut grass	Do.	2¾	Feb. 13	Oct. 6	100	90	Oct. 13	Oct. 15	8 5	3	57½	360	34 0	217

The formation of Approaches. By Mr DAVID GORRIE, Annat Cottage.—The term *approach* is applied to the road by which a stranger is supposed to proceed from the public road or highway, through the park or lawn, to the house. The approach breaks off either from the turnpike or main road of communication through that part of the country in which the house is placed, or from a cross or district road connecting different parts of the same country-side. The distinction is important, for by its aid a question or problem may be solved which has given rise to much difference of opinion amongst landscape-gardeners; namely, whether the approach ought to break off at right angles, or proceed from a curved part of the public road, so as to appear a continuation thereof. Like many other disputed points connected with the art of laying-out grounds, this may be settled by referring, not to opinion or precedent, but to the principles of beauty and harmony, and the causes that lead to the pleasing of the imagination: and it should be remembered that the business of the ornamental gardener is to beautify the country in general, as well as to adorn the grounds belonging to a private individual. The argument on our side of the question is thus stated by Repton in his *Sketches and Hints*:—"Where an approach quits the highroad, it ought not to break from it at right angles, or in such a manner as robs the entrance of importance, but rather at some bend of the public road, from whence a lodge or gate may be more conspicuous, and when the highroad may appear to branch from the approach, rather than the approach from the highroad." In seeking to confer importance on the entrance-gate, this eminent designer forgot that, in some cases, by so doing, the scenic effect might in other respects be injured. Were a public highway—a mail-coach road of former days—to proceed straight towards an entrance-gate, and there to turn aside as if the approach were its natural continuation, a degree of importance would indeed be conferred on the place, but the general effect would be incongruous. It would be unfit and improper thus to bend a public road to suit one of a private character. It would, in a manner, be acknowledging the justness of the notion, that a sense of property is necessary to the enjoyment of a landscape; an idea that is every day practically contradicted, and was disowned by Addison, who, in No. 411 of the *Spectator*, expresses it as his conviction that a man of a polite or cultivated imagination often feels a greater satisfaction in the prospects of fields and meadows than another does in their possession. A cultivated taste gives a person a kind of property in every beautiful object that he beholds; and an individual lacking such taste can only have but a very *material* connection with anything partaking of beauty which he may have a legal title to call his own. It seems right on many grounds that an

approach should break off at right angles, or nearly so, from a road that constitutes a highway of communication between large towns, or between distant parts of the country. Enough of importance may be conferred on the entrance-gate by causing it to recede from the road, leaving part of the ground naturally belonging to the policy unenclosed, with some trees outside the fence similar in age and kind to those within it. Besides the idea of importance, this would display liberality and patriotism on the part of the proprietor. The general practice has been conformable to the principle here sought to be advocated, in as far as approaches entered on from highways are concerned. There are but few places in Britain where a main line of road seems to turn aside in order to give importance to a gate; but there are cases in which it is commendable to adopt the rule quoted above in all its parts, only substituting the words "district road" for "high-road." A cross-road intersecting an estate, and appearing to lead to farmeries, or at most to rural villages, may be imagined as in some sense belonging to the estate through which it passes; and when such a road bends aside at a gate, while the traveller, by continuing a straight course, enters at the gate and passes along the approach, there is a due measure of importance given to the gate and to the house whereunto it belongs; and this is secured, not at the expense of injuring the congruity of the scenery, but in a manner betokening much fitness and propriety. Examples of the two distinct classes of entrance-gates indicated may be found not far from the Scottish metropolis. The grounds at Oxenford Castle lie adjacent to a main line of road, and the approaches to the Castle are very fitly made to turn aside from the road, while the public highway is carried on in a straight line. The south approach to Prestonhall, in the immediate neighbourhood, is entered on after the traveller has already turned aside from the mail-coach road; and in this case the road opens to the public, which, after it passes the gate, becomes a cross-road, chiefly for local use, and turns aside, allowing the line of road passing through the gateway to be carried straight on. The two cases are different, and may serve to show in what manner a harmonious and pleasing effect may be produced by opposite means, when the materials are different. But were the character of the gates at both places altered, and were a mutual transposition effected, fitness would no longer exist. In the one case there would be an unwarrantable assumption of importance, and in the other an equally unnecessary demeaning of an essential and important feature. In this, as in may other matters, a universal rule must often be found inapplicable. But there are several requisites to a good approach, enumerated by Mr Repton, to which no exception can be made, and which will be found, laid down as they are in his *Sketches and Hints* in the form of rules and axioms,

valuable practical guides. The principles on which they are founded have been acknowledged by all the best designers; and some of the following remarks are intended to be illustrative of what they, in a concise manner, state.

But the character of the gate and gate-lodge are first to be decided on, after having ascertained the proper manner in which the approach should break off from the road. Where this is at or about right angles, a pleasing effect will be produced by placing the gate considerably far back from the road, with a crescent-shaped intermediate way leading towards it on each side, and a segment of plantation between this crescent and the public road. When the plantation extends on the opposite side of the road from that on which the gate is situated, there is the appearance of united, continuous, and uninterrupted property, the idea of which is pleasing even to those who have no interest in the soil, and this because of that love of contemplating the infinite which is natural to the human soul. It is paying unnecessary deference to the principle of symmetry, to divide the gate-keeper's house into two boxes, with an archway between them, as has been done at the entrance to Heriot's Hospital. It is right to have solid masonry on each side of an arched gateway, for without this the arch, and the gate itself, would appear to be useless and absurd; but it is easy to connect a gateway of this kind with the policy fence in an architectural manner, although there may be a lodge only on one side. It is, in general, advisable that a gate-lodge should imitate the architectural character of the house or castle to which it belongs. A Grecian lodge to a Gothic castle would appear unfitted for its situation; and it is to be wished that the erection of rustic lodges—or, in other words, thatched hovels—were altogether interdicted, since they are at once architecturally unfit, and, in most instances, unsuitable and unwholesome, habitations for human beings. But, in imitating the character of the house, the general style, and not the particular details of form and construction, should be aimed at. A gate-lodge is the dwelling of a working man, and its architectural ornaments will be better adapted to their position if of a simpler kind than those of the mansion. Any particular style in architecture can adapt itself to buildings for various uses. A Grecian villa may be erected without imitating a Grecian temple; and a cottage may be characteristic enough without attempting to pass itself off for a villa in miniature. But instances have occurred in practice, in which it was found advisable to give to the lodge a different expression of style from that belonging to the house. Repton built a Gothic lodge to a Grecian mansion, but then the mansion was nowhere to be seen from the road, while an ancient castle in ruins formed a conspicuous object in the landscape, and gave its name to the place. Gilpin, another high authority in matters of taste, considered that lodges ought to be constructed in

conformity to the nature of the scenery around them, rather than in regard to the architectural character of the house to which they belong. If all other things are favourable, however, it seems right that lodges should have something of an architectural kind about them, sufficient to mark their connection with the residences of their proprietors. While there may be something about the ornamental carvings or mouldings of a gate to give it an architectural character, the primary consideration in forming an object of this kind is, to give it the appearance as well as the reality of strength. The weight of a gate depends on the upper hinge; and the joints at the several corners must needs be strong, if a gate having only upright and horizontal bars is found able to preserve its rectitude. No swinging gate is fit for its position, unless the principle of the diagonal has been acknowledged in its construction. Nothing can more readily show the absurdity of irrational mimicry than a splendidly finished wooden or iron gate, whose joints have failed for want of a diagonal, so that it seeks support from the ground at the end farthest from the hinges. An object constructed avowedly for a certain use, should, in the first place, manifest the principle of utility, and then beauty will be all the more easily conferred upon it. But having remained long enough at the gate, it is time to inquire into the principles that offer guidance to the designer in forming the approach itself. Gates and lodges properly form a distinct part of the subject.

Immediately on entering the gate, the stranger should be led on for some distance in a straight line; for when the road curves round and skirts the fence of the park, the idea may be entertained that the ground is of very limited extent. In taking the first impressions on the mind of a stranger as illustrative of the principles of design, it may be well to bear in mind that impressions of a similar kind will continue to arise in the minds of those to whom the objects are familiar; although, in the case of one who has never had an opportunity of receiving them before, they must, of course, be most vivid. It is certainly an ill preparation for receiving a favourable impression of a house or its grounds, to have one of an unfavourable kind forced on the attention, either by the gate, lodge, or approach. With regard to the line of road most suitable, this will depend on the character of the ground; but in all cases it is requisite to consider that an approach is a road to a house in its primary sense, and it should not lead a person out of his way merely for the sake of displaying certain views of scenery; far less should the landscape-gardener lead the stranger, in the words of the garden-poet,

> Many a tedious round,
> To show th' extent of his employer's ground.

A good rule to be observed is, that when an approach does not occupy the shortest line of route between the gate and the house,

some natural or artificial object ought to intervene, in order to show that a straight line has not been departed from without reason. In level or slightly undulating ground, this point requires some care; but where the road can be made to wind amongst rocks, or along the side of a hill or a valley, the staking-out of the line is the easiest part of the work, and an error can scarcely be made unless designedly. A curve in an approach, however beautiful, may, if on level ground, require a certain disposition of trees to make it rational. It is an understood law amongst designers, that a double bend should never be seen from one point of view; or, in other words, that one curve should be passed by ere the next be seen. When artificial obstacles, such as mounds of earth or imitations of rocks, are raised in order to account for a bend in an approach, it is necessary that they have a natural appearance, else their effect will be lost. Cuttings and embankments may be left with greatest safety in such a state as that they may always appear to have been artificially formed. As a road is a work of art, and will appear to be so continuously, there is no use for hiding those works of art which are necessary to its formation. The sides of a cutting may be left at a uniform angle, and, to complete the idea of that dominancy which art has acquired in the situation, they may be planted with exotic shrubs. Where the road has been made through rocky strata, the miniature precipices may be adorned with such Alpine plants, creepers, and climbing roses, as are not natives of the place. It is where the spade and the pick have evidently been at work in forming the sides of an approach, that exotic vegetable ornaments are admissible. In other cases, where the ground on each side of the road is manifestly in its natural condition as to sectional profile, it seems best to adopt the practice of Mr Gilpin, author of *Practical Hints on Landscape Gardening*, whose ardent love of forest scenery and rural embellishment led him to advocate the use of native plants in ornamenting the grounds on both sides of an extended approach. He considered that, in a picturesque part of the country, natural groups of trees and shrubs, such as holly, thorn, furze, and broom, would be most conformably placed along the approach; and that, if the country around had a romantic character, the ground near the road might be suitably adorned by angular projections of rock, roots of trees holding fast by rugged banks, large forest-trees scattered about in wild profusion; while on each side of the approach might be such plants as ivy, fern, and foxglove. The common viper's bugloss (*Echium vulgare*) might be included, where the soil is dry and shallow; and were an exotic plant which has been quite naturalised admissible, a fine effect might be formed by covering a bank with *Coronilla varia*, a plant which spreads so freely in a wild state, that only a botanist would be reminded that it is not a native. The botanist applies the term exotic to all plants that are

not natives of Britain; but the landscape-gardener, in adorning a piece of ground with the materials of nature, can afford to consider as natives all plants that have become fairly naturalised. In these days of botanical science, the practice of the picturesque gardeners of a former generation does not meet with a due share of consideration. It seems at present to be considered, that no park scenery can be fine unless its materials be foreign. Certainly, art has a greater triumph when exotic trees and shrubs are used; but the natural gardens of the days of Addison and Pope had the advantage in this, that they spoke more to the soul, though less to the head. In them the principles of beauty and harmony were acknowledged, and objects were not prized on account of their rarity or value in the estimation of a botanist. The native plants of a country have endearing associations connected with them which no foreigners can possess; and they were arranged by the gardeners of the picturesque school for general, and not for individual, effect. It seems enough if the lover of exotics receive as his own those parts of the ground skirting an approach where art has manifestly been at work in altering the surface-outline; and in such places it will be but fitting that art should have the choice of the ornamenting materials. The sides of a public highway, where a deep cutting has been made through a rising-ground, may be conformably adorned with exotics, as has been done where a cutting had to be made for the public road near Oxenford Castle; but in other situations, where the works of art have been confined within the limits of the road itself, such plants as bays and rhododendrons might appear intrusive, and far less suitable than our own sweetbriar, dog-rose, and elder.

It is not necessary that a road through a level park, where no obstacle to a straight course exists, should be exactly straight. A footpath, or a path formed by cattle, in such a situation, will generally be found to have two slight curves at each end; one to the right, at the gate of ingress, and another to the left, at the opposite extremity. By preserving these curves, and making them artistical, an approach might be formed sufficiently direct, yet not too formal; but an error in design has been committed when an approach bends away from a straight course, while a level expanse of grass seems to invite a person to leave the gravel, and seek a short road to the house across the lawn. The curves in an approach will conform themselves in some measure to the character of the scenery, even though this may be undesigned. On ruggedly picturesque ground there will be one or more sudden turns, and these may sometimes be taken advantage of in drawing attention to certain prospects in the landscape. Where the picturesque style of gardening has been adopted, it is not necessary to have the curves in an approach highly artistical, or such as may be formed on the plan by compasses, nor to have the grass at the

edges neatly cut; but in all cases an approach should be finished in a superior manner to the public roads in the vicinity, being kept smoother, and formed of finer materials. On gently undulating ground, where the scenery is beautiful rather than picturesque, sudden bends must be avoided; and the curves will be all the more conformable, if regular, easy, yet decided, and so united together as to render it impossible to tell where the one begins and the other ends. The "line of beauty" will guide the road and the walk wherever it forms the sectional surface-line of the ground. It can seldom be successfully imitated on level ground, and never where the scenery is rugged. That the ground may not appear too limited in extent, it is requisite that the house be not seen immediately on entering the gate; and if not naturally hid from view, trees must be used as an artificial screen. The first view of the house should also be the best that can be obtained; and it may be well to conceal it till it can be seen in perspective, so that it may appear to have breadth as well as length and height. It is essential that the house present itself as the leading feature—the concentrating point—in the landscape, from whatever part of the approach it may be seen. There will always be more or less of art manifested in a park, though laid out in the picturesque or natural style, and the house has a right to appear as the leading artistical feature. Besides this, it may be so placed as to attract attention amidst the native beauties of the scenery. Seen from a public road, or from any part of the country-side, without the boundaries of the park, it exists merely as a feature in the landscape; but whenever the gate is entered, the definite article requires to be used—it is themain feature. Sometimes, when the approach is very extended, the house might possibly be seen at so great a distance as to have a diminutive appearance; but this will be obviated if the designer takes care not to let it be seen till a view at once good and commanding (the latter word being applicable to the house, and not to the position of the spectator) can be obtained. Some remarks on this subject, as well as a lucid summary of the principles regulating the curves of a serpentine approach, are contained in Loudon's *Suburban Architect and Landscape Gardener.* There was a time, after the fashion of the geometric style had passed away, when roads, walks, and the boundaries of plantations were all made conformable to the line of beauty; but since Loudon wrote on ornamental gardening, many of the philosophical principles of the art have been on record, although not universally practised.

The attention of a stranger proceeding along an approach should be chiefly directed to any interesting views of scenery which the park itself affords. It is reasonable to expect that the house will be placed in a situation commanding the finest view of distant scenery that can be attained, consistently with due atten-

tion to other objects; such as shelter, a supply of water, and conveniency of access. If the same view be seen from any part of the approach, its novelty, and consequently part of the pleasure it is fitted to impart, will be lost when viewed from the windows of the house. Novelty is one of the three qualities in objects that, according to Addison, please the imagination, the other two being greatness and beauty. But when the windows command no distant view, and when one can be had from any part of the approach, the case is reversed; and as the windows look only into the park, the approach may be made to serve some of the purposes of a "drive"—namely, to lead to points where views of an interesting kind, both within and without the park, may be obtained.

But, in the majority of instances, the scenery of the park and grounds will be that most appropriately displayed from the approach. For increasing the effect of this scenery, "running foregrounds" are requisite, and these will chiefly consist of groups of trees scattered here and there in such a way as that the beauties beyond them may sometimes, like Hector M'Neill's roadside cottage, the residence of "Meg Howe, the widow," be "halflins seen, and halflins hid." The "running foreground" on each side of an approach may be ranged so as to add much to the attractiveness of the more distant scenery. It is well if there is a slight ascent within the gate, and another on approaching the house. In extended grounds, there may be both ascents and descents in the line of approach; and in uneven grounds it may require some engineering in order to preserve easy gradients in either case. When a hill is ascended, there is a good excuse for forming a winding line, the greater length of which may be compensated for by greater easiness of draught. After ascertaining the distance of the house from the gate, and its altitude as compared with that of the public road, a calculation may be made, by means of which a uniform gradient might be attained from one end of the approach to the other. This is supposing the house to stand on a sloping bank, or on the summit of a low hill, with more or less of an ascent at every part of an imaginary straight line between the gate and the house. Arrived at the termination of the approach, there may be found an illustration of the necessity that exists for a joint consultation between the architect and the landscape-gardener before either of them lays down a fixed plan. From want of such consultation, the privacy of the drawing-room front, or the flower-garden front, may sometimes be destroyed by its being also made the entrance-front; and there is an instance on record of the kitchen and offices being placed at the wrong end of the house, so that all communication between them and the public road was effected by a continuation of the approach passing before the windows of the principal rooms. These rooms should

occupy a front of the building different from that at which the entrance is placed, not only for the sake of privacy, but also that the view which they may command be seen from their windows by the stranger for the first time. Being so seen, its effect will be heightened, whether it be a view of distant scenery, or of a flower-garden immediately under the walls.

One of the disadvantages attendant on an approach formed up to the entrance of a house, through a straight avenue of trees, is, that only a limited portion of the front can be seen, while there is no possibility of obtaining a perspective view of two sides of the building, which view is always the most pleasing, unless the architect had forgotten that he was not designing a street house, on only one front of which it is necessary to bestow ornament. An avenue near a house is liable to various other objections; it divides the lawn into two halves, thus destroying the unity of the landscape. Unless in parks avowedly laid out in the ancient style, an avenue may harmonise ill with the rest of the scenery; and the picturesque style of planting has this advantage, that its views are like those in a kaleidoscope, no two of them alike; whereas the view down one avenue is just a counterpart of that along another. To place an obelisk or vase at the far end of an avenue, is to confer on such an object the unenviable character of courting notoriety; and an avenue, to be satisfactory, must have its termination concealed. These objections to avenues must of course be balanced against arguments in their favour, and such arguments must be familiar to all lovers of the grand, the stately, and the gloomily magnificent.

The width of approaches varies from eight to twelve feet, according to the character of the house, its distance from the road, the possibility of two carriages meeting and having to pass each other, and the opportunities that such carriages might have of turning aside on the grass where the road might be too narrow. It is unnecessary to have a broad expanse of gravel before the entrance. By turning the road at its usual width round a circle of grass, the object that might lead to the formation of a wide landing-place of gravel may be as well if not better attained.

Sometimes an approach, in part of its course, is bordered by corn-fields or other objects which it may be thought desirable to hide. A permanent screen of trees and shrubs, in such a situation, must either have been thinly planted or timeously thinned, so as to allow of free growth to the underwood, and also to allow the side-branches of the trees to grow freely. Thick planting and lack of thinning have ruined many a screen of this kind, as well as many plantations, both economical and ornamental, or intended to be so.

Suggestions on Peat-Charcoal. By J. Towers, M.R.A.S.E.—

Referring to No. 32, p. 549, of this Journal, the reader will find a "Report on the economical uses of Peat." It comprises a series of experiments, and inductions from them, indicative of deep research, the results of which are given with great candour and ability. Few persons who are at all acquainted with the processes of chemical analysis can be at any loss to perceive the skill of Dr Anderson as an operator, and the fidelity of his reports. Much has been, and continues to be, written upon every point connected with the subject of Irish bóg-peat, and Dr Anderson has touched upon four of those points, adducing powerful arguments upon each, derived from actual repeated experiments; and I must confess he has arrived at conclusions adverse to the high expectations formed by the advocates of peat-charcoal as an unfailing disinfectant and deodoriser, and available in all cases for the converting of fecal substances into a manure of incalculable importance.

In so far as Dr Anderson has exposed the fallacy of the theory that charcoal absorbs ninety-five volumes of ammonia, every impartial reader must, I think, go with him, and, considering the cost price of peat-charcoal in Ireland, and especially in Scotland, must relinquish the hope of any remuneration from it, if its absorbent power in respect of ammonia be deemed an essential requisite. But peat-charcoal has other and far higher claims for general patronage, if we may attach credence to reports which meet us from time to time. One of these is now before me, headed "Sanitary and Fertilising Properties of Peat-Charcoal," from *The Artisan*. From this report I will extract a few paragraphs, after endeavouring to set at rest the ammonia-absorptive power of peat-*charcoal*, by suggesting a very simple experiment, which any person may undertake who can procure a pound of the genuine article. It accords sufficiently with Experiment No. 1 of Dr Anderson, p. 555.

A glass filtering vessel—than which none is better than a tall wine-quart, the bottom cut off—is to have a piece of canvass tied over the neck, and to be inverted over a deep tumbler-glass. Fill the bottle to within an inch, or little more, of the cut edge, with the bog-peat charcoal, powdered, and just so moistened with rain-water as to bring it to that state of screened garden-mould in which it is used for potting: the peat can thus be made to lie compact, without interstices, by shaking and patting with the hands, and will permit the regular passage of fluid through its entire substance.

Prepare a solution of carbonate of ammonia (the common smelling-salts) in the proportion of 1½ drachm (= 90 grains) to the imperial pint of rain-water, which measures 34.66 cubic inches. When the salt is quite dissolved and shaken up, present a strip of glass, moistened with muriatic acid, over the surface of some of

the liquid contained in a cup, and observe the fume produced by the union of the ammoniacal vapour and the muriatic acid gas; then taste and smell the solution, in order, by these three tests, to obtain some idea of its volatile potency. Pour slowly about an ounce measure of the ammoniacal liquor over the peat-charcoal, distributing it equally over the surface, and wait its absorption; then add more, with the like precautions, till a drop fall from the bottle into the receiving-glass. In the Experiment No. 1, by Dr Anderson, we find that "the first drop which filtered through was as *distinctly alkaline as the original fluid*, indicating that no rapid or abundant absorption had taken place."

In the trial which I propose,* I would wait till the fluid ceases to yield any single drop, and then try whether it gave evidence of the presence of ammonia either to the taste, smell, or by applying a strip of glass moistened with muriatic acid. If it should so respond, I would return the whole of the filtered liquid over the peat-charcoal, and let it pass again through its substance, repeating the tests. If, after three trials, ammonia should pass through in sufficient quantity to be discoverable by the three tests, the inefficiency of peat-charcoal as an absorbent would be substantially proved.

But we must not stop at this point, for the advocates of the *sanitary* and *fertilising* properties of peat-charcoal contend, that if the simple proposition of applying it to the sewage of towns were carried into effect on an extended scale, the result would be—1st, Profitable for surplus labour in the country; 2d, Efficient means of sanitary reform in towns; and, 3d, An increase in the supply of food. "By the use of labour, and a material at present valueless, a marketable commodity would be produced, admirably adapted to promote the public health, and which, when it had fulfilled this important mission, would vastly and cheaply increase the productive powers of the soil." The supply of peat is said to be inexhaustible—the field of its beneficial application boundless.

Again—"Capital and enterprise, directed by science, would transmute the peat-bogs of Ireland and the Highlands—which now render vast regions damp, dreary, and desolate—into Nature's storehouse of a new and vivifying element of sanitary, social, and commercial progression. All other substances—artificial products obtained in the laboratory—invariably act by new combinations of matter, when applied as sanitary agents. The smell evolved by chlorine, when used to purify the air, and other compounds recently recommended, are familiar examples of the effects obtainable by the use of agents which, while they destroy or fix one gas, liberate another scarcely less offensive."

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* The trial may be varied by substituting caustic ammonia (*Liquor ammonia fortis*) for the carbonate.

The deodorising powers of peat-charcoal, in contradistinction from any predominant attraction for ammonia or its salts, form the *point d'appui* upon which rests the theory of its most zealous friends. Although they avow that "infectious and contagious diseases may exist with intensity for a long time, and be propagated without the existence of any offensive odour; yet (say they) the converse is *not true*, for you cannot have the *continuance* of an offensive smell, such as that emitted by decomposing animal or vegetable matter, without lowering the vital powers," &c. &c., to a similar purport.

Few, I imagine, can doubt the depression of animal spirits occasioned by the exhalation of the foul gases from cesspools and drains. These hydrogenous gases forcibly attract and combine with the oxygen of the air, and thus deprive it of its vital element. Hence they convert it to an actual poison, by causing a predominance of the *azotic* or life-destroying nitrogen. Few also can hesitate to believe that hundreds of persons witnessed the numerous experiments performed by Mr Jasper Rogers,* wherein the foulest nightsoil was instantly and effectually purified by intermixture with a moderate portion of the charred peat.

Dr Anderson's second experiment may be taken in proof of the deodorising power of Irish peat-charcoal. I copy it verbatim from p. 556. "Experiment 2.—This was made in a way similar to No. 1, but with *putrid urine*, which had a distinctly alkaline reaction and an offensive smell. The first drop which passed was *perfectly alkaline.* It had lost its colour and putrid smell, but had a distinct and *pure* ammoniacal odour. Here the decolourising and deodorising property, which belongs more or less to all sorts of charcoal, was distinctly shown, but there was no evidence of an absorption of ammonia. It was obvious from these experiments" (compare Experiments 3, 5, 7) "that the absorption was extremely small—so small as to be practically of no importance; and its use for this purpose cannot be recommended to the farmer."

As the deodorising agency of peat-charcoal appears to be admitted by every party, particularly as a purifier of that most offensive substance, nightsoil, I beg to suggest that the authorities whose duty it is to regulate the movements of those public nuisances called "night-carts," might effect a great reform, and one, at the same time, highly beneficial to agriculture, by directing the application of a certain quantity of the peat to every privy or cesspool before and during the transfer of the soil to the cart. Every concomitant of the process, as now conducted, is offensive. The "*fade*" and sickening odour inhaled by the labourer—its diffusion through the atmosphere during the dead of night, and

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* By a paper before me, I find that these experiments were made at the Mechanics' Institution, Southampton Buildings, London, in October 1849.

the pertinacity with which it retains possession of the air to a great extent, when that is calm and in a moist condition—these are nuisances which ought not to be suffered to exist.

The writer of the paper in *The Artisan* alludes to a trial made to ascertain the purifying quality of the charcoal, which was reported in several periodicals many months since. He tells us that "he witnessed a cesspool in Gray's Inn Square, which had for some time been in such a state as to be a nuisance in the neighbourhood, completely deodorised by having peat-charcoal sprinkled over it." He adds:—"We have the authority of Sir Edward Burrough, Bart., chairman of the Board of Health in Dublin, for the fact, that a large and most offensive cesspool in a central part of Dublin had been emptied, with the use of peat-charcoal, and its contents at once carted in broad day, without the inhabitants in the neighbourhood being aware of the nature of the operation, or that any offensive matter had been removed."

Before I proceed farther in search of evidences and causes, justice and chemical truth require the admission that, by endeavouring to prove too much, a good cause is materially injured. Epidemics affecting animal health and life, and epiphytics which seriously affect and perhaps destroy entire crops, have recurred time out of mind, and passed off without assignable or traceable cause. The Asiatic virulent *cholera* never visited these islands till about the year 1832, and its appearance then, almost simultaneously with that peculiar condition of fever called *influenza*, (a malady which, if it *existed*, had not here assumed a violent type till the early part of the eighteenth century,) could not be assigned to any malaria produced by exhalation from cesspools, drains, and foul closets.

Would it not be safer and more reverential to consider such afflictive visitations as warnings of a merciful Providence, instructing us to adopt remedial measures, by which the health and comfort of the people might be improved and enhanced? Whatever we admit, or affect to deny, certain it is that ill-drained premises, foul sewers, defective cesspools, and the consequent soaking to saturation of the ground, are grievous nuisances. Persons must be affected more or less by the lowering and degradation of the vital principle, and therefore it becomes an imperative duty to remove the proximate causes of so much mischief.

Residing in the large and widely extending town of Croydon in Surrey, I observed the daily progress of those sanitary operations which, so far as will concern the thorough sewer drainage and water supply of the whole locality, must be important. I can attest the previous miserable state of the ground in the lower parts of the town, in consequence of the inadequate measures long adopted. In lieu of the old system of brick-and-tile draining, (in many places altogether useless,) every road, street, court, and

alley, new drain-pipes made of glazed stoneware are laid at certain required depths, determined by theodolite observations, with a gradual fall towards a main central drain of very large calibre, which will convey the whole sewage of the town and suburbs into a building where the solid and fluid parts are to be separated by filtration—the former to be carried off through a rivulet, which it will enter at a very considerable distance from the town. As an adjunct of the greatest importance, a supply of water is provided in a tank of about 900,000 gallons, at an elevation which will furnish every dwelling to its uppermost storey with pure water, at a pressure that will carry off through all the drains every particle of sewage matter with extreme rapidity, so as to preclude the possibilty of any fecal accumulation. The outlay upon these works is great; but, at all events, the town will exhibit one grand experiment, conclusive, at least, of what can be effected by cleanliness on the one hand, and which, on the other, will show what may be done in the process of deodorisation. Ere long, I trust that the Croydon local board of health may be in a position to report faithfully the efficacy and value of peat-charcoal, of which trustworthy evidence, in the great way, has not as yet been furnished.

This remark leads to a further consideration of the experiments made by Dr Anderson, and reported by him, all of which (see pp. 555-557) concur in disproving the absorptive power that, unfortunately, is assigned to this charred peat in the closing paragraph of the article from *The Artizan.* "We confidently affirm that the health and lives of the victims of defective sanitary arrangement might, under Providence, have been preserved by the application of a small quantity of peat-charcoal; and this will be the more readily admitted, when it is borne in mind that *the gases* generated and given off by cesspools *are the ammoniacal,* sulphuretted hydrogen, oliphiant and carbonic acid gases, and that *charcoal absorbs these gases,* according to De Saussure, in the following proportions:—

Ammoniacal gas, . .	90 times its volume
Sulphuretted hydrogen, .	55 ditto
Oliphiant gas, . . .	35 ditto
Carbonic acid, . . .	35 ditto."

Dr Anderson repudiates this vaunted absorbent power; see his remarks at p. 555, previous to Experiment No 1.

Here we may appositely introduce the following passage from p. 558—"The absence of absorptive power in peat-charcoal led me to inquire whether or not *peat itself* possesses this property in any greater degree—a matter which it is of some importance to determine, as that substance is so commonly added to the manure-heap as an absorbent. The experiments were made with an excellent peat from Dargavel, Renfrewshire, where it occurs of

considerable depth. That which I employed was taken from the surface, and from depths respectively of 2½, 3½, and 4½ feet. It gave an ash, the analysis of which yielded the following results:—

Silica,	21.916
Peroxide of iron,	10.914
Alumina,	7.092
Lime,	10.131
Magnesia,	11.706
Potash,	2.410
Soda,	5.100
Sulphuric acid,	11.379
Phosphoric acid,	1.616
Chlorine,	0.571
Charcoal,	16.989
	99.824 "

This ash is rich in valuable constituents; but we do not learn its proportion compared with the weight of the peat consumed. The reader must also bear in mind that the quantity of residuary charcoal is far less than that contained in peat merely *charred*, and not incinerated. At page 552 we meet with calculations on the cost of production and the value of the charcoal; from which it appears that one ton costs 23s. in Ireland, at a low calculation, whereas in Scotland the same weight would cost 30s. In a note, p. 552, it appears that the sale price had risen to £2 the ton; but from a quotation in the *Mark Lane Express*, I learn that it was selling, in October last, at £3 per ton. The first question that will therefore present itself, must refer to the cost of its application for the purposes of *manure*. The purifying agency of peat-charcoal cannot be questioned. The putrid odour vanishes immediately, as shown by experiments 5 and 6, and admitted by Dr Anderson. The experiment, also, of Mr Way, and the various trials made by myself, and reported on several occasions, prove that common garden earth, used as a filtrating medium, will deodorise the foulest liquid manures; and not so only, but that, to the point of saturation, it will attract and fix the ammoniacal and colouring ingredients. Earth itself, if thrown over the contents of closets and privies, is familiarly known to act with much effect as a purifier. The question, therefore, becomes more urgent, whether, at £2 or £3 per ton, peat-charcoal, employed as a deodoriser of nightsoil and the solid deposits of filtered sewerage, will remunerate the farmer? The inquiry naturally leads to a consideration of the absorptive powers of pure uncharred peat, as compared with those of its charcoal. Fifteen experiments stand recorded in Dr Anderson's Report, from which I select No. 12, p. 560, as comprehending the substance and bearing of the series: " 500 grains of surface peat " (see p. 559) " were taken, and a highly *alkaline* and *putrid urine* added, until the mixture acquired a slightly alkaline reaction, for which purpose 9 cubic inches were required. Its putrid odour was only *slightly* diminished. After exposure to the air in a thin

layer, it weighed 642 grains, and was found to contain 2.105 per cent of nitrogen. The whole quantity of nitrogen present amounted therefore to 13.5 grains, of which 4.03 were originally present—leaving, as the quantity absorbed, 9.47 grains, which is equal to 11.49 grains of ammonia, or more than 2 per cent of the peat. It must, however, be understood that part of this ammonia exists in the urine in a non-volatile state, in which it has no tendency to *escape*, and it is only a part of it which can be considered as, strictly speaking, *retained* by the peat; and it is for this reason that the absorption appears larger than when pure ammonia is made use of, as in experiment 7."

The experiments, as Dr Anderson observes, are sufficiently varied to show that raw or pure peat can absorb a considerable quantity of ammonia, and also *retain* it, under even unfavourable circumstances. The *peat-charcoal*, however, very feebly attracts and fixes ammonia, but perfectly destroys putrid matters; thus deodorising and rendering them innocuous, which raw peat fails to do. Here, then, parties are at issue.

If the fixation of ammonia be the chief desideratum, the value of peat-charcoal is reduced almost to zero. If, on the other hand, the complete purification of millions of tons of fecal matters, which tend to pollute some of the finest rivers, be almost a *sine qua non*, then peat-charcoal (the preparation of which would remove and employ to purpose a useless deposit) becomes an agent of vast importance. Price and outlay lay claim to very serious consideration. At present they appear threatening, and go far to justify Dr Anderson's opinion "that the value of peat-charcoal as a manure, and absorbent of the valuable constituents of manures, is not such as to justify the farmer in employing it, or to encourage us in attempting its introduction into Scotland."

Experiments on a broad scale are progressing, and also on the *distillation of peat*—on the latter, I am assured, with high promise of success. Time must determine the results of both; but assuredly the abomination of bad drainage, foul leaky cesspools, and unhealthy water, becomes more and more evident, and correspondingly urgent.

Condition and Wages of the Agricultural Class in France. From "Annuaire de l'Economie Politique et de la Statistique."—The following table shows the extent of each species of cultivation in France, (four hectares being equal to ten acres nearly)—

	Hectares.
Cereals,	13,900,263
Vines,	1,972,340
Other crops,	3,442,139
Artificial grasses,	1,576,547
Market gardens,	766,578
	21,657,867

The above does not include the fallow-land, which would raise the amount to 28,421,000 hectares, or about half the surface of the country—the remainder being composed of pasture-land, forest, &c.

In order to estimate the annual outlay upon the cultivated lands, we must first ascertain the number of labourers, or, in other words, we must estimate the agricultural population of the country—an operation of some uncertainty, as the census does not clearly distinguish the employment of the population. According to the best information, we would, however, estimate it as follows:—

8,000,000	inhabitants in towns, ...	= 22 per cent.
1,000,000	do. in country, not being cultivators of the soil, . .	= 3 "
27,000,000	agricultural labourers in the country and in villages, . . .	= 75 "
36,000,000		100 "

Agriculture, therefore, employs in France about three-fourths of the inhabitants. In England, not more than one-third are so employed.

The usual proportion of $4\frac{1}{2}$ to each family gives six millions of agricultural families in France. The sex and age of the individuals of these families are as follows:—

Labourers, .	6,000,000	men.
" .	6,000,000	women.
" .	6,000,000	adult children.
	18,000,000	
	6,000,000	children.
	3,000,000	infants.
Giving	27,000,000	of inhabitants depending upon agriculture.

By spreading the 18,000,000 of able-bodied labourers over the 21,500,000 hectares of cultivated land, we have one labourer to each $1\frac{2}{10}$th hectare, (3 acres,) of which about 2 are under cereals, and 1 under vines and other crops.

The proportion of inhabitants employed on the cereals and other crops varies with each district, and is influenced both by the variety of the soil and the density of the population; but, as a general rule, the extent of ground to each labourer is greater in France than in Germany at the same latitude.

The money-value of the crops enables us to draw most important conclusions bearing on the subject of this essay. Their yearly value has been estimated at 5,152,653,000 francs = 240 francs per hectare (= £4 per acre.) The expense of cultivation, not including the value of the seed, is 3,016,261,000 francs = 140 francs per hecture (= £2, 6s. per acre,) which is paid to the labourer, or gained by those who cultivate their own land. If the total sum be divided amongst the six million families, we have for each an annual wage of 500 francs (= £20, 16s.;) or per day 1 franc 37 cents (= less than 1s.)

But these labourers are not constantly employed—indeed the duration of their employment does not exceed 200 days per annum; we must therefore increase the above estimate of their daily earnings as follows :—

	Francs.	Cents.	s.	d.		Francs.
6,000,000 men at	1	50	(=1	3)	=	1,800,000,000
6,000,000 women at	–	75	(=0	7½)	=	900,000,000
6,000,000 children at	–	25	(=0	2½)	=	300,000,000
			Total,			3,000,000,000

This gives, for the labour of three persons, to each family a daily wage of 2 francs 50 cents, (2s. 1d.) Without doubt, in some districts the labourers are paid more; but we have endeavoured to show the average wages which may be received, without taking special account of the occasional or local superfluity or scarcity of labourers—though, as will be perceived, we have made due allowance for the length of time they may be off work.

Over and above the labouring population, there are the children, whose earnings are too small to alter materially the conclusions above arrived at.

The question of life or death, prosperity or famine, is intimately bound up with the above figures; and the importance of the inquiry will be perceived when we recollect that the individuals concerned count by millions, or three-fourths of the population of France. And besides, is it possible, at the present price of the necessaries of life, out of a sum of 500 francs, to maintain a family of 4 or 5 persons for twelve months?

The primary article of consumption is wheat. At the rate of 3 hectolitres (=66 gallons=1 qr. ½ bush.) to each individual, each family would require 13 to 14 hectolitres, costing 210 francs to 280 francs (£8, 15s. to £11, 10s.,) according as the price varies between its present value, 15 francs, and its occasional cost, 20 francs. In the first instance, there will remain for other articles, 290 francs (£12;) in the second, 220 francs (£9, 11s.) But when the price of wheat, in years of scarcity, reaches to 25 or 30 francs per hectolitre, the entire earnings of the family, except £2, 10s. to £3, will thus be absorbed in the purchase of this article alone.

The above figures give rather a curious commentary upon the vaunted pleasures of a country life. At such prices as we had last year, the utmost the agricultural labourer could manage was to pay for the salt required for his *soupe maigre*, and which he must be content to swallow, even though it be not seasoned with meat or butter. And when the family is surprised by the misfortune of an addition to its number, the hundred sous (5s.) required by the presiding matron for her assistance, can only be procured by months of previous self-denial. The whole energy of their lives is devoted to desperate struggles to pay the miller and their landlord; nor, to their credit be it spoken, does their extreme

poverty ever induce them to forget the claims of their children for something in the way of education.

It would, however, be a serious error if the wishes or the wants of an agricultural labourer were compared with those of an inhabitant of a town. In the first place, as a set-off to his misery, the inhabitant of the country enjoys the inestimable blessing of labouring in pure air, and surrounded by nature in her most beautiful forms; nor is there anything in his employment which necessarily injures his health, or debases him to a mere assistant of a machine, as is too often the case with our manufacturing population. At the same time we regret to confess that the improved circumstances of the rest of our people have not as yet reached our agricultural population. In the reign of Louis XVI., Arthur Young referred with horror to the black bread eaten by them. Since that time half a century has passed, and whilst our agricultural produce has tripled in value, the labourers who produce it continue, from custom and from necessity, to eat a detestable bread made from rye, barley, or pease, and potatoes; and, to make the matter still worse, it is badly baked, without yeast; and being sometimes kept for weeks, it becomes covered with mould, and altogether presents an appearance enough to turn the stomach of a savage.

In such a country as ours, (France,) where nothing can be done without the intervention of Government, it is much to be desired that a law could be enforced to give our agricultural population a dietary equal to that of the poorest part of England. And we have often been surprised to hear the declamation of our would-be patriots on the subject of providing all our population with animal food. Would it not be better, in the first place, to see that they had something better than pig's meat for their daily bread?

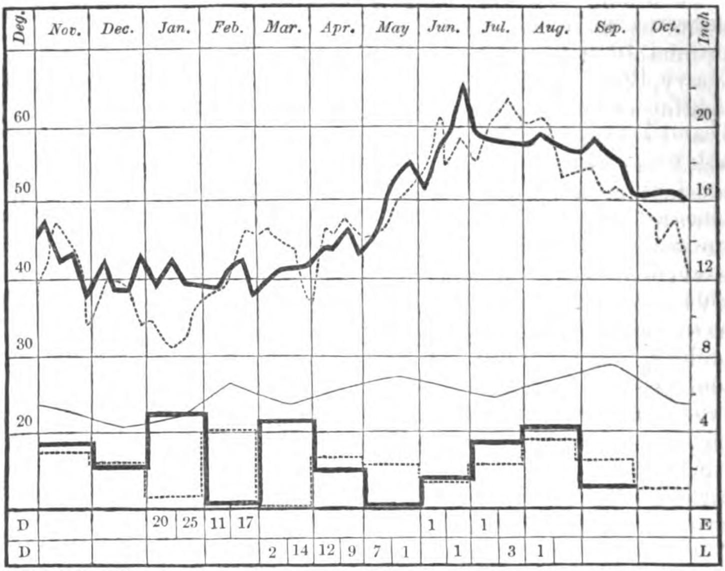
Thermometrographia for the Agricultural Season ending with October 1851. From observations at Annat Cottage, Perthshire: N. Lat. 56° 25′; Elevation, 170 feet.

*Explanation.**—The weekly mean temperature is indicated by the upper dark line, the dotted line showing the weekly mean for the previous season. The scale of degrees is at the left-hand side. The lower dark line shows the monthly depth of rain; the dotted line, the monthly depth for the previous season. The scale of inches is at the right-hand side. A middle line shows the monthly barometrical average. To provide a scale for it, the line of 30 degrees may be called a line of 30 inches, and the space between it and the line of 20 degrees divided into tenth parts of an inch.

From the mildness of the winter there was almost a uniformity in temperature between the months of December, January,

* See woodcut over the page.—Ed.

February, and March. The severest frost was in November. Excepting the last week of June, the summer weeks were rather



cooler than usual; but in September and October the temperature was high, and this brought up the mean for the "vegetating season" (from March 20 to October 20) to 52.96 degrees, which is higher than that for any of the four previous seasons. The average for the five past vegetating seasons was 52.32 degrees. In 1846 the mean was much higher.

The summer was dry, and the effects of the drought were injurious to oats, barley, and clover, on early soils. May was dry throughout; and in June and September little rain fell. February was very dry, and hence a favourable seed-time followed a remarkably wet January. But though the season has been dry, several of the months had an excess of rain; and this brings up the depth for the whole twelve months to 32.05 inches, or four inches above the average. As the vegetating season included the last eleven days of March, most of which were very moist, the depth of rain for this season was as much as 17.54 inches, giving the fair average of 2½ inches for each month; so that the lengthened drought was the effect of unequal distribution of the rain that fell. The depth for the three summer months gives an average of only 1¾ inch for each month: the depth of rain for the agricultural season ending with October 1850 was 27.8 inches.

The mean temperature for the twelve months was 48.22 degrees: the mean for the previous twelve months was 47.27 degrees. November and the three following months had a tem-

perature above the average, as had also May, September, and October. The other five months were under the average. December and the three following months were nearly uniform in temperature, as is manifested by the diagram, and may thus be expressed in figures:—Dec. 40.5°, Jan. 40.45°, Feb. 40.4°, and March 40.95°. As seen by the rows of figures at the bottom of the diagram, marked between D and E for days earlier, and between D and L for days later, the mildness of the winter caused a remarkable forwardness in the vegetation, which the season maintained till the beginning of March. Towards the end of January, flowers bloomed nearly a month before their recorded time in 1850; but towards the end of the rather cool and moist month of March they were about a fortnight later. Vegetation gained a week by the beginning of May, and, by the beginning of June, was again as forward as in 1850 at the same date. Days were now gained and lost on both sides; and, on the 12th of August, the autumn crocus closed the list of floral indicators, by appearing just a day later than last year. Harvest was, however, fully a week later in commencing—cloudy and showery weather in August having prevented hasty ripening. In the earlier fields, moreover, there was a late or second growth after the Lammas rains, especially in those parts where the corn had been stinted and almost parched by the drought of May and June; and, in many instances, the fields usually earliest were latest in being cut down.

There was a high atmospheric wave in September, the barometer for thirteen successive days having ranged above 30 inches. The annual mean of the barometer was a shade lower, as the depth of rain was somewhat greater, than in the previous season. The mean was 29.496 inches, being lower than that for the previous season by the nineteen-thousandth part of an inch. Had the weather been clearer and more frosty in winter, the barometrical mean would have been higher, and the depth of rain of course less, than for the year ending with October 1850.

With the exception of some unseasonable frosts in summer, there has been nothing to countenance the belief that an open winter is generally followed by a backward season for vegetation. If there was frost in summer, there was also at least one day of heat unequalled since 1846, and unsurpassed since 1826.

Evergreens, as a means of Shelter. By Mr Peter Mackenzie, West Plean, Stirling.—Among the many illustrated advertisements that appear from time to time, one may be seen headed "Comfort in a storm." A well-clad gentleman is represented as enjoying much comfort in the midst of a pelting shower of rain and wind, being protected by means of a covering that would not be easily penetrated by the wet: in the background, a poor-looking half-clad individual is seen striving to get along, and yet

making little progress, while "the loosened tempest reigns," and,

> Low waves the rooted forest, vexed, and sheds
> What of its tarnished honours yet remain ;
> Dash'd down and scattered by the tearing wind's
> Assiduous fury its gigantic limbs.
> Thus struggling through the dissipated grove,
> The whirling tempest roves along the plain ;
> And on the cottage thatched, or lordly roof,
> Keen fastening, shakes them to the solid base.

Many a lordly home and humble cot in our country may be made more comfortable in our cold and stormy months, if they had more shelter afforded them. This might, in many cases, be easily accomplished by means of evergreens properly cultivated Scotland, in many places, is better adapted for the growth of some evergreen shrubs than many parts of England. Some winters make sad havoc among the Portugal and common laurels in the south, while those in the north are little injured. The following explanation has been given on the subject:—

The principal circumstances in which evergreens physiologically differ from other plants are, the hardness of their cuticle, the thickness of the parenchyma of their leaves, and the small number of breathing pores formed on the surface of those organs. These peculiarities taken together enable them to withstand heat and drought with more success than other plants, but are often not sufficient to protect them against such influences in excess: hence we find them comparatively uncommon in those parts of the continent of Europe where the summers are hot and dry, and most flourishing in a moist insular climate like our own. This is rendered more intelligible by a comparison of the proportions borne by their evaporating pores or stomates, and those of deciduous plants. As far as this subject has been investigated, it appears that their leaves are usually altogether destitute of such organs on the upper side, and that those of the latter are mostly fewer in number and much less active than in deciduous plants.

The time has long passed by when laurels were protected with blankets to save them from frost. They have since that time been the means of protecting other things, and ought to be more generally cultivated. Where shelter is required—and, as one remarks, considering the great importance of evergreens in a climate like that of Great Britain, where they flourish in such unrivalled beauty, and form so much natural protection to bleak, exposed situations—they cannot be too extensively planted.

From the days of Evelyn to the present time, many directions have been given about the planting and management of evergreens, and it is still a disputed point among cultivators respecting the best time when they should be planted. We have no intention, at present, to make any attempt for having the question settled, but will only make a few remarks, drawn from observation and many years' practice. Among all the instructions which we recollect of having

received respecting the soil in which most evergreens may be grown, we think one ingredient has been omitted where healthy and vigorous plants are wanted, especially in exposed situations.

It has passed into a proverb, that a dumb man never gains the law; but we will endeavour to make out our case from the testimony of living witnesses that are very mute, except when greatly agitated, when heavy gales and wintry winds are endeavouring to force a passage through their body; but, sheltered by their green garments, we may in a great measure realise the

> Poet's dreams
> Of vernal landscapes, of Elysian vales
> And islands of the blest! where, hand in hand,
> Eternal spring and autumn rule the year,
> And love and joy lead on immortal youth.

It may be thought a strange thing by some that we should recommend that dead and despised material called peat as an agent for sheltering and beautifying our native land; but facts are stubborn things, and we will now state a few of them.

Some years ago we planted evergreens in different kinds of soil, expecting that they would grow in a short time to form useful and ornamental plants. In one place the ground was somewhat stiff; but, before planting, a small hollow had to be filled up to bring the ground to the slope that was required: the hollow was filled with rough peat, without any preparation whatever, except breaking it small and exposing it to the weather. Plants about the same size were put in, the shrubs being chiefly common and Portugal laurels. The situation is somewhat exposed to the south-west gales, which are often very cutting to such plants; however, those in the peat pushed their way in spite of all opposition, while those on the east and west, and within a few yards of those in the peat, made very little of the progress which plants should do that are intended for shelter. We measured some of them lately, and we found that those in the peat were about 16 feet in diameter near the ground, and about 10 feet high—healthy, thick-set plants; while those on the east side, in the clayey soil, were about 5 feet in diameter, and about 4 feet high, and those on the west side, in somewhat similar soil, measured only 4 feet in diameter, and about 3 feet high. None, we think, would be inclined to doubt that the difference in size and other conditions of the plants was owing to the soil in which they grew.

In another place, where the soil was better, being formerly part of an old kitchen garden, and also better sheltered, plants of a similar nature had another trial, alongside of others planted in peat at the same time, and as nearly as possible of the same size. Those in the peat measured about 24 feet in diameter near the ground, and were about 20 feet high; while those adjoining them, in the old garden soil, measured only about 15 feet in diameter, and about 10 feet high.

The slow growth of evergreen shrubs in exposed aspects, where the soil is not suitable for the plants, may be one reason why they are less used for shelter than they ought to be. In many places the dead leaves strew the walks in the woods and other places, and during the winter months there are few green leaves to be seen; even the pale wild-flowers are withered; and the situation becomes still more cheerless when the frost hangs blackening on the stems of leafless trees, and the dew-drops fall in frozen showers. In such a place the yellow hues of autumn would be welcome; but they are gone, and shine no longer on the hills and plains, and there is little shelter left even for the redbreast and blackbird. But how different is the appearance of winter where evergreens abound?

Twenty years ago the *Journal of Agriculture* told the public that it is in winter that evergreens delight the eye and enliven the sylvan scene. When the oak is shorn of its foliage, the pine and the holly present the verdure and recall the images of spring. It is surprising, then, that so little care is bestowed on so easy a method of adding to the interest and variety of the deciduous forest, namely, by a judicious intermixture of those beautiful plants. Besides the purposes of ornament, too, they are not without value for their wood: they may grow as underwood, without interfering with the progress of the larger timber; and, if we can be allowed to think of cruelty amidst the lovely serenity of the forest shade, they afford to the sportsman the means of enjoying his captivating but destructive art. Nor is it because these plants are too delicate to brave the severity of our winter that they are not more generally planted: many hardy evergreens stand with impunity even the highest altitude at which forest trees can be raised in this island. The common holly and the rhododendrons, for example, never suffer in their wood or their foliage from our severest winters.

Where evergreens are planted in masses, and are at all healthy, some will require to be transplanted, in order that the others may live and become better and more ornamental plants. Now, it is well known to those who have had experience in the transplanting of evergreens, that when the plants are of considerable size, a great object is gained when they can obtain a good ball of earth along with the roots when the plant is removed. But there are certain varieties of soil in which evergreens will grow when planted in a young state, and yet with the greatest care they can hardly be removed with earth attached to the roots: the consequence is, that many of them die, unless the plants are greatly reduced in the head by means of the saw and the pruning-knife. Although we have always found it otherwise, where a considerable quantity of peat is mixed with the soil in which such plants are put, and where such a precaution is taken, evergreens may almost be lifted at any season; and it is little different from the mode of shifting a plant growing in one pot into

another; as we commonly find, where peat abounds in the soil, there is an abundance of fibre so matted and interwoven together, that there is no difficulty in lifting large plants with good balls, without any previous preparative or need of apparatus to keep the earth together until the plants are removed to their new places of abode.

In some seasons the east wind proves injurious to newly-planted evergreens, when it blows direct upon them for some time in the spring. Such a wind is said to be both cold and dry, and abstracts moisture from the leaves of the plants faster than the roots can supply it; by which means newly-planted laurels, and plants of a similar nature, are sometimes much withered, especially if poorly supplied with fibres to supply the demand for moisture made upon them. We have tried a temporary shelter for young plants for a few months after the plants were put in, which was of considerable benefit to the shrubs in protecting them from the influence of so biting an enemy. The defence against the east wind was easily made, and cost little expense—it being simply a small number of stakes driven into the ground, on the north and east sides of the plantation, about four feet high from the ground; and between them branches of spruce fir were afterwards warped, so as to form a green fence, that did not look disagreeable even in a flower-garden.

Before closing our remarks on the transplanting of evergreens, some useful lessons may be learned by noticing how much planters differ on this subject. The late Dr Neill remarks, that near the house, and about the flower-garden, evergreen shrubs should abound. There should be at least one evergreen for two deciduous shrubs. The transplanting of evergreens requires some attention. It is often desirable to have them at once of considerable size, and fine large specimens may sometimes be found in public nurseries or market-gardens. A year before these are to be removed the roots should be cut, by passing a sharp spade all around and below them, thus encouraging in them the setting out of new and tufted roots, and greatly facilitating the subsequent removal of the plant. The roots of any kind of evergreen should be as little as possible exposed to the air. Nicol, in his *Calendar*, makes some judicious observations on the best time for transplanting evergreens. He prefers the middle or end of April, or rather the precise time when the plant begins to grow for the season, when the buds swell and the new leaves are about to be unfolded. The roots are then in an active state; and if the transplanting be speedily accomplished, no check is sustained. Next to this late period of the spring, the beginning of August is a good time; for a second growth then takes place, as careful observers must have remarked, occasioned perhaps by the showery weather which generally occurs at that season.

Errington says that he has invariably found autumn the best

season for transplanting evergreens, for the following reasons: 1st, The atmosphere of autumn is by far less dry and capricious than that of spring; 2dly, Evergreens have then the greatest number of healthy leaves in full action whereby to produce roots; 3dly, The surface of the soil possesses in an eminent degree the remaining heat of the past summer; 4thly, As spring always brings its own business, and that by no means trifling, it is folly to delay that until the spring which may be done at least equally well in autumn; 5thly, "First come first served," is an old maxim; and in the case of purchasers from a nursery, those who come first get the choice—a circumstance by no means to be lost sight of.

The late Mr M'Nab's opinions and practice of planting evergreens are very different from those we have mentioned. He says that he has planted evergreens at all seasons of the year, with more or less success,—though from the middle of June to the middle of August is the most unfavourable time for planting them. The particular seasons which he recommends are, late in autumn, or during winter, or very early in spring; that is, from the middle of October till the middle of December, provided the weather and the ground be favourable—*i. e.*, no frost, no drying wind nor much sunshine, and the ground not too much saturated with wet, either from continued rain or from the nature of the soil. Some even recommend, when the plants have been long out of the ground, to be particular in drying their roots, by exposing them as much as possible to the sun and air, and not to be nice in planting. But the following are Mr M'Nab's views on this subject:—"One of the principal things to be attended to in planting evergreens," says he, "is to fix on a dull day for winter planting, and a moist day for spring and autumn planting. There can be no secret in the proper treatment of evergreens. If there were, I should say that it is in preventing their roots from becoming dry when out of the earth; to choose moist and cloudy weather for planting; and still better, if we had the power, by foresight or otherwise, to secure a continuance of such weather some time after they have been planted. If the roots of evergreens be allowed to dry when out of the ground in spring, it is scarcely possible to prevent their suffering considerably, and showing this injury a long period after they are planted." And hence he recommends the winter months as being those in which we are best able to attain these purposes, the day being generally moist and cloudy; and even when it is sunshine, the sun being a short time above the horizon, its influence is trifling in effect. But where that kind of weather cannot be obtained, he then recommends the work to be performed in the evening, after the sun gets low, particularly in spring and autumn planting.

Dr Lindley, in his *Theory of Horticulture*, says, "I entirely agree with Mr M'Nab, that the earliest time at which planting can be effected is, upon the whole, the best; a conclusion to which

he has come from his extensive practice, in which my own observation of a great deal of planting for the last twenty-five years coincides, and which is, in all respects, conformable to theory." And he says, "An evergreen differs from a deciduous plant in this material circumstance, that it has no season of rest; its leaves remain alive and active during the winter, and consequently it is in a state of perpetual growth. I do not mean that it is always lengthening itself in the form of new branches—for this happens periodically only in evergreens, and is usually confined to the spring—but that its circulation, perspiration, assimilation, and production of roots are incessant. Such being the case, an evergreen when transplanted is liable to the same risks as deciduous plants in full leaf, with one essential difference—the leaves of evergreens are provided with a thick, hard epidermis, which is tender and readily permeable to aqueous exhalations only when quite young, and which becomes very firm and tough by the arrival of winter; whence the rigidity always observable in the foliage of evergreen trees and shrubs. Such a coating as this is capable in a much less degree than one of a thinner texture, such as we find upon deciduous plants, of parting with aqueous vapour; and, moreover, its stomates are few, small, comparatively inactive, and chiefly confined to the under side, where they are less exposed to dryness than if they were on the upper side also. But although evergreens, from their structure, are not liable to be affected by the same external circumstances as deciduous plants in the same degree, and although, therefore, transplanting evergreens in leaf is not the same thing as transplanting a deciduous tree in the same condition, yet it must be obvious that the great extent of perspiring surface upon the one, however low its action, constitutes much difficulty, superadded to whatever difficulty there may be in the other case. Hence we are irresistibly driven to the conclusion, that whatever care is required in the selection of a suitable season, damp, and not too cold for a deciduous tree, is still more essential for an evergreen."

The difference of opinion among planters respecting the proper time for transplanting evergreens, may come to be better understood when a better acquaintance is obtained of geology and meteorology, and perhaps a little more knowledge of vegetable physiology. There are certain soils in which certain plants will make fewer fibres than in others; and such plants, when removed to another place, if they are of considerable size, will not be so likely to live as those which are lifted with double the quantity of fibres, and a good ball of earth attached to them. Again, most planters recommend that evergreens should be watered after they are put in, without taking into consideration the nature of the geological formation into which the plants are put. For instance, the water recommended by Mr M'Nab for the sandy soil of the Edinburgh Botanic Garden, would almost float the plants out of

the pits if they were made in the clay formation. Again, there are certain localities that may be considered, under the government of atmospherical influence, injurious to vegetation to a greater extent than others. For example, evergreens exposed to the cold and dry east wind, especially if the wind comes whistling through a wood, will have fewer chances to live than plants of a similar nature under the protection of rising ground, where the wind passes over them, or only touches them in its gentlest manner.

By the use of peat, many of these difficulties may, to a great extent, be got over. When shrubs are planted, there is seldom manure to spare for them; and the notion is pretty general that although certain plants must have abundance of manure, shrubs can do without it—and little they get. They are not, in many places, allowed to get a shovelful of their old cast-off garments, which are collected and wheeled away, to be prepared for food for plants in another department of the garden. But they should have food to live upon as well as animated beings—and they would be pleased with peat, and would fatten upon it; and such food can be obtained at small cost in many parts of the country that are very destitute of vegetable clothing, especially that kind of it which would prove a shelter to man and beast. When peat is used with a liberal hand where evergreens are grown, plants with an abundance of young roots might be obtained at all seasons; and failures on removal will be seen, if care be at all bestowed upon them; and when large plants are removed, with plenty of peat among the roots, less water will be required. When such plants are put into a sandy soil, the absorbent nature of peat will at once saturate it with moisture, keep a stock of water on hand for the future wants of the numerous mouths that have to be supplied, and maintain the plant in a vigorous state of health.

The Cottage Homes of England. By J. W. STEVENSON.—The subject of cottage-building is now attracting much attention from various quarters. It has recently acquired nearly all the importance of a "movement." Philanthropists are earnest and eloquent in their pleadings for a reformation of the present system—architects deem the subject not unworthy of special professional consideration—and landlords themselves have, in many instances, given practical proof of a praiseworthy desire to improve the accommodation of their servants and labouring dependants. Prince Albert, with that enlightened philanthropy which characterises all his actions, has had erected a set of model lodging-houses for agricultural labourers; and it was only the other day, as we learn from the newspapers, that the Duke of Northumberland gave orders for the erection of no fewer than one thousand cottages on his estates. Many of our landed proprietors, both in Scotland and England—

and we would fain say even in Ireland—are following the same generous course. These are gratifying facts, indicating as they do that a strong feeling has set in in favour of a class which, it must be confessed, notwithstanding the poetic celebrity of "the cottage-homes of England," has been too long neglected. No one, we presume, will deny that, generally speaking, (although we rejoice to think that on some estates the case is otherwise,) the condition of the agricultural labourer is not what it ought to be; and we believe it is vain to expect to elevate a man, either mentally, morally, or religiously, until you place him in some degree of physical comfort. The substitution, then, of a better class of houses for the present often wretched hovels of the agricultural labourer, must be the initiatory step to his elevation in other and higher respects.

We, therefore, welcome the volume before us as a valuable contribution on an important subject. It is the work of a practical man who knows well what he is writing about. Mr Stevenson presents us with plans of cottages in ten different styles, several of which, however, are intended as dwellings, not for ordinary labourers, but for farm-bailiffs, or "cottage farmers." We shall in a few words describe one or two of the plans, premising that they are all, for the sake of economy in building, constructed double, to accommodate two families. The labourer's cottage, which Mr Stevenson himself apparently thinks most of, is a two-story erection, each family occupying both stories of their respective halves of the building. The ground-plan provides for each tenant a house-place or parlour, 13 by 12½ feet; a kitchen, 12 by 10½ feet; a pantry, 6½ by 6 feet; a store-closet underneath stairs, and a tool-house, 5 feet by 4. The upper story contains three sleeping-rooms, (two of them having fireplaces,) 13 by 10½ feet, 12 by 10½, and 8½ feet square respectively; besides a closet or store-room. The house is surrounded by garden ground, at the extremity of which, behind, are situated the out-offices. The cost of erecting two such cottages in the midland counties of England is estimated at £220 plain, and £275 ornamented. Mr Stevenson gives the plan of a plain one-story cottage, comprising a living room, 23½ by 17 feet, and three bed-rooms, (two of them 11½, and the other 10½ feet square,) with closet and pantry. The expense of a pair of such cottages (which, we concur with our author in thinking, embrace all that is required in an improved dwelling for the labouring man) is stated at about £180. The cottages for small farmers and the upper class of agricultural labourers are, of course, more ambitious in style, and proportionably more expensive—the cost ranging from £340 to £420 per pair. These estimates, it must be remembered, are for brick erections, and would be considerably larger for stone-built cottages. Indeed, we suspect the great fault to be found with Mr Stevenson's plans—

with one exception we have mentioned—is, that they are too grand for the purpose; that they deal rather too handsomely with the cottager. We heartily commend his volume to the consideration of all interested in the subject of cottages.

We trust that, ere long, we shall see the surface of the country studded with an improved style of cottages for our peasantry, "their country's pride;" and let it be remembered that any estate will not be the less to be admired because the eye, when surveying its broad, well-cultivated acres, takes in the tidy and comfortable cottage of the labourer with the magnificent mansion of the landlord.

The Lentil. A new British Crop.—We spoke, in the *Journal of Agriculture*, for July 1851, of that *ancient* vegetable—so often mentioned in the Bible, so prolific, and, above all, so nutritious—which M. Guillerez, a French professor in our city, has acclimatised by his unwearied efforts, at great cost, and without any other reward than the gold medal of the Highland and Agricultural Society. Whilst rolls of tobacco and starch have received prize medals from the juries of the Great Exhibition, a new food, introduced into our country at the very moment when the potato seems to have lost its vitality, and threatens to disappear from the vegetable kingdom, as many plants have done before from exhaustion and overgrowth—the lentil, that made an attractive article of the admirable collection exhibited by Messrs Lawson and Son, as well as in a separate form, was passed unnoticed.

In 1851, M. Guillerez has seen his disinterested efforts repaid, for the fourth time, with a success beyond his most sanguine hopes, from a spot sloping to the north, and exposed to all the winds, at the back of South Queensferry. He has gathered 2¼ bushels, (167 lb. weight,) 5¾ lb. only having been sown, and the rain in August having spoiled a great part of the crop, which was then budding. The lentils sown between rows of beans have produced, on an average, 30, 25, and one row even as much as 61, for 1; and, besides, he had a splendid crop of beans. Between the rows, propped by stakes, he had planted cabbage, cauliflower, salsify, beet-root, leeks, which all throve most beautifully. The lentils were so prolific that, if it had not been for the rain that damaged them to a great extent, they would have produced more than a hundred-fold. Indeed, one of our most eminent noblemen, (Lord Rosebery,) who saw them drying on ropes in large bunches, could not refrain from expressing his astonishment at the abundance of the crop. The provost of South Queensferry has grown the lentil successfully in an open field, and sown broadcast; but Mr Dundas of Dundas Castle putting too many beans among his, they were choked. However, he is to try them this year on a large scale. M. Guillerez tried a small spot as forage: he cut them twice, and they grew to the height of four feet.

Here is a recipe for cooking lentils. The plainest and best mode of preparing them is to steep them in cold water an hour or two; then to withdraw them, and place them in a goblet with enough of water to cover the surface, a little butter or a bone, some salt, and a little parsley. Place the whole on a slow fire. They must boil slowly, and you must take care to add water enough to keep the surface covered, but merely covered. You may boil them with ham, bacon, sausage, or merely with water and salt, to prepare them afterwards with onion *à la maître d'hôtel*. In schools, barracks, or large boarding establishments, they are often merely boiled in water and salt; then allowed to cool, and the water to run off, and in which state you dress them with oil and vinegar, &c., like a French salad. When the lentil is bruised or ground into meal, it makes an excellent "purée" with wild-fowls or roasted game. It is prepared also like peas, for soups, dumplings, puddings, &c.

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sep. 6.	42	8	29	1	20	10	27	6	26	6	28	1
13.	42	2	29	11	21	4	28	2	33	8	28	2
20.	41	2	28	4	19	11	29	4	33	2	27	11
27.	40	4	29	4	19	5	27	3	29	6	28	0
Oct. 4.	39	2	29	2	19	1	27	6	34	9	28	0
11.	39	6	28	7	18	0	27	7	29	4	27	3
18.	39	2	29	4	17	2	28	7	29	7	26	7
25.	40	9	28	8	18	3	26	6	31	8	25	6
Nov. 1.	39	6	29	0	17	10	27	4	31	0	28	8
8.	39	10	28	11	17	9	28	0	31	8	28	4
15.	40	3	28	11	19	0	28	1	31	4	28	8
22.	40	6	28	10	18	9	27	2	32	4	30	1
29.	40	1	30	1	19	7	26	4	31	1	29	3

EDINBURGH.

Date.	Wheat.		Barley.		Oats.		Pease.		Beans.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sep. 3.	39	4	27	9	21	9	37	6	38	0
10.	34	4	24	9	20	1	36	2	36	10
17.	39	2	23	9	19	8	35	4	35	10
24.	37	0	23	5	19	9	36	6	37	4
Oct. 1.	39	5	24	4	20	10	36	8	37	5
8.	40	1	24	8	20	8	35	6	35	6
15.	39	9	24	9	20	2	34	2	34	2
22.	40	1	25	5	20	4	36	0	37	1
29.	40	7	25	8	21	0	35	6	36	6
Nov. 5.	40	1	25	9	20	10	34	8	35	7
12.	39	2	25	4	20	2	34	0	35	1
19.	39	4	25	1	19	5	33	8	34	4
26.	38	10	25	3	18	10	32	0	32	7

LIVERPOOL.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sep. 6.	37	9	28	4	19	1	26	6	26	2	30	6
13.	38	3	27	3	17	9	25	8	27	6	30	10
20.	36	2	26	6	18	10	26	4	28	6	31	5
27.	37	10	27	4	18	0	25	9	27	9	33	10
Oct. 4.	37	5	28	3	18	9	25	6	27	6	33	2
11.	35	0	26	8	19	2	26	2	29	2	32	4
18.	38	0	25	4	19	6	26	3	30	4	32	0
25.	37	7	24	5	17	6	26	0	34	10	32	11
Nov. 1.	36	7	25	8	17	3	26	8	32	1	29	2
8.	36	0	25	10	17	10	26	4	30	6	32	2
15.	36	4	26	0	18	3	26	8	29	8	32	4
22.	36	0	25	10	18	5	26	4	28	6	29	6
29.	36	4	26	2	19	1	26	0	27	6	33	10

DUBLIN.

Date.	Wheat, p. barl. 20 st.		Barley, p. barl. 16 st.		Bere, p. barl. 17 st.		Oats, p. barl. 14 st.		Flour, p. barl. 9 st.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sep. 5.	19	7	13	10	9	4	10	7	13	4
12.	19	4	13	5	9	10	10	0	13	3
19.	19	0	13	0	9	10	10	2	13	4
26.	19	1	12	1	9	8	9	7	13	2
Oct. 3.	19	6	12	5	9	6	9	10	13	3
10.	19	9	12	10	9	4	10	0	13	4
17.	20	0	13	2	9	9	10	2	13	6
24.	21	2	11	8	9	3	9	7	13	7
31.	21	4	12	0	9	6	9	4	13	5
Nov. 7.	21	1	12	1	9	4	9	2	13	4
14.	21	3	11	6	9	2	9	4	13	5
21.	20	1	10	2	9	0	9	11	13	2
28.	19	3	12	5	9	6	9	4	13	1

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vic., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.				Barley.				Oats.				Rye.				Pease.				Beans.			
	Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.		Weekly Average.		Aggregate Average.	
1851.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Sept. 6.	38	9	40	7	26	1	26	1	20	1	21	3	26	2	26	10	25	11	27	0	30	4	30	10
13.	38	5	39	11	26	1	26	2	19	5	20	9	25	0	26	9	27	8	26	10	28	9	30	6
20.	37	8	39	2	25	7	26	1	18	4	20	4	26	2	26	4	28	2	26	11	28	6	30	0
27.	36	7	38	5	25	0	25	11	18	0	19	9	25	4	26	1	27	0	26	10	28	8	29	8
Oct. 4.	35	7	37	8	25	1	25	7	17	6	19	2	24	2	25	7	27	1	27	1	27	10	29	1
11.	35	6	37	1	25	2	25	6	17	3	18	7	25	0	25	4	26	2	27	0	27	8	29	7
18.	36	0	36	7	24	9	25	3	17	0	17	11	23	6	24	10	27	2	27	3	27	6	28	2
25.	36	9	36	4	25	5	25	2	17	5	17	7	23	8	24	7	27	7	27	2	28	6	28	1
Nov. 1.	36	6	36	2	25	7	25	2	17	5	17	5	24	10	24	5	27	5	27	1	28	6	28	1
8.	36	1	36	1	26	1	25	4	17	6	17	4	25	1	24	4	28	2	27	3	28	10	28	2
15.	36	4	36	2	26	7	25	7	18	1	17	5	26	0	24	8	28	3	27	5	28	8	28	3
22.	36	9	36	5	27	0	25	11	18	3	17	7	23	2	24	4	28	7	27	10	29	8	28	7
29.	37	2	36	7	27	1	26	3	18	8	17	11	25	7	24	8	28	10	28	2	30	5	29	1

FOREIGN MARKETS.—Per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1851.	-	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Sept. ..	Danzig	34 6 - 40 0	16 6 - 21 6	15 6 - 19 0	23 0 - 28 6	22 0 - 28 0	20 6 - 26 6
Oct. ..	Danzig	36 6 - 42 0	17 6 - 22 0	15 0 - 18 6	24 6 - 30 0	22 6 - 29 6	21 0 - 27 0
Nov. ..	Danzig	33 6 - 38 6	18 0 - 24 0	15 0 - 18 0	25 0 - 31 6	23 0 - 30 0	22 0 - 28 0
Sept. ..	Hamburg	36 6 - 40 0	20 0 - 25 0	15 6 - 19 0	24 6 - 31 0	21 6 - 28 0	20 6 - 26 0
Oct. ..	Hamburg	37 6 - 41 6	21 6 - 27 0	15 6 - 20 0	25 6 - 33 6	23 0 - 29 0	21 6 - 27 0
Nov. ..	Hamburg	36 6 - 41 0	22 6 - 29 0	14 6 - 17 0	26 6 - 36 0	24 0 - 30 6	22 0 - 28 0
Sept. ..	Bremen	33 6 - 38 0	16 6 - 21 0	14 6 - 18 6	24 0 - 31 0	21 0 - 24 6	20 0 - 26 0
Oct. ..	Bremen	34 0 - 39 6	17 6 - 23 6	15 0 - 19 0	24 6 - 32 0	22 6 - 25 0	20 6 - 27 0
Nov. ..	Bremen	34 6 - 40 0	17 6 - 23 0	14 0 - 17 0	26 6 - 34 0	24 6 - 29 0	22 0 - 28 0
Sept. ..	Königsberg	32 6 - 38 0	16 6 - 22 0	13 0 - 16 6	24 0 - 32 6	22 0 - 26 6	20 6 - 26 0
Oct. ..	Königsberg	34 0 - 40 0	18 6 - 28 0	14 6 - 18 0	26 0 - 35 0	24 0 - 28 0	21 6 - 27 0
Nov. ..	Königsberg	33 6 - 39 6	17 6 - 26 6	14 0 - 17 0	26 0 - 33 6	23 0 - 27 6	20 6 - 26 0

Freights from the Baltic, 1s. 6d. to 3s.; from the Mediterranean, 4s. 6d. to 7s. 6d.; and by steamer from Hamburg, 1s. to 1s. 3d.

THE REVENUE.—From 10th October 1850 to 10th October 1851.

	Quarters ending Oct. 10. 1850.	Quarters ending Oct. 10. 1851.	Increase.	Decrease.	Years ending Oct. 10. 1850.	Years ending Oct. 10. 1851.	Increase.	Decrease.
	£	£	£	£	£	£	£	£
Customs....	5,251,883	5,335,073	83,190	..	18,738,805	18,798,262	59,457	..
Excise......	4,103,343	4,139,854	36,511	..	12,913,102	13,256,120	343,018	..
Stamps.....	1,507,028	1,432,564	..	74,464	6,145,780	5,965,785	..	179,995
Taxes......	186,613	165,025	..	21,588	4,335,086	4,301,093	..	33,993
Post-Office..	227,000	306,000	79,000	..	820,000	970,000	150,000	..
Miscellaneous	48,727	68,452	19,725	..	376,569	332,058	..	44,511
Property Tax	1,867,864	1,870,136	2,272	..	5,413,701	5,355,697	..	58,004
Total Income	13,192,458	13,317,104	220,698	96,052	48,743,043	48,979,015	552,475	316,503
	Deduct Decrease		96,052		Deduct Increase		316,503	
	Increase on the qr. ..		124,646		Increase on the year		235,972	

TABLES OF BUTCHER-MEAT.—Per Stone of 14 Pounds.

Date.	London. Beef.	London. Mutton.	Liverpool. Beef.	Liverpool. Mutton.	Newcastle. Beef.	Newcastle. Mutton.	Edinburgh. Beef.	Edinburgh. Mutton.	Glasgow. Beef.	Glasgow. Mutton.
1851.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Sept. ..	4 0 - 6 0	4 6 - 7 0	4 8 - 6 10	5 9 - 7 0	4 6 - 5 9	4 8 - 6 9	5 6 - 6 3	5 6 - 6 6	5 9 - 6 9	5 9 - 7 2
Oct. ..	4 0 - 6 9	4 6 - 7 3	4 6 - 6 9	5 6 - 7 0	4 0 - 5 9	4 9 - 6 9	5 9 - 6 6	5 9 - 6 9	5 9 - 6 9	5 9 - 7 0
Nov. ..	4 3 - 6 9	4 6 - 7 3	4 6 - 6 9	5 6 - 7 0	4 3 - 6 0	4 9 - 6 9	5 6 - 6 6	5 9 - 7 0	5 6 - 6 6	5 9 - 6 9

PRICES OF ENGLISH AND SCOTCH WOOL.—Per Stone of 14 Pounds.

ENGLISH.	s. d. s. d.	SCOTCH.	s. d. s. d.
Merino,	12 6 to 17 0	Leicester Hogg,	10 6 to 15 6
.. in grease,	9 0 to 14 0	.. Ewe and Hogg,	9 0 to 13 6
South-Down,	13 0 to 16 6	Cheviot, white,	10 6 to 13 6
Half-Bred,	10 0 to 13 0	.. Laid, washed,	7 6 to 10 0
Leicester Hogg,	10 6 to 16 0	.. unwashed,	6 0 to 8 0
.. Ewe and Hogg,	8 0 to 13 0	Moor, white,	6 0 to 8 0
Locks,	6 0 to 8 0	.. Laid, washed,	5 6 to 7 0
Moor,	5 0 to 6 0	.. unwashed,	5 0 to 60

ON ARTIFICIAL MANURES IN GENERAL, AND BONE-MANURE IN PARTICULAR.

BY DR AUGUSTUS VOELCKER, Professor of Chemistry in the Royal Agricultural College, Cirencester.

SCARCELY anything has accelerated the progress of agriculture so much as the introduction of artificial manures. Their more extended application, indeed, is an improvement in agriculture which has changed the usual routine of farming in no small measure, and which, therefore, may be regarded as the beginning of a new epoch.

By means of artificial manures the produce of this country has been considerably augmented; new crops have been introduced into the usual rotation, and land so sterile that it would not repay the costs of cultivation in the usual way has been forced to yield at once remunerative crops. Before the introduction of bones, superphosphate of lime, and guano, the culture of the turnip crop in its present extended state was unknown. At the present time, green crops, except under particular circumstances, cannot be raised economically without some addition of one kind or other to the ordinary manure produced on the farm.

There are few farms in this country on which home-manure is produced annually, and in sufficiently large quantities to bring the land to its maximum state of fertility: some of the land, consequently, must remain in a condition in which it cannot possibly yield a quick and fair profit to its occupier, unless he has recourse to some kind of artificial manure.

Even supposing the land to be in such a condition as to yield the maximum return which the usual rotation of crops is capable of furnishing, the extra command of artificial manures would still materially increase the profits of the farmer, as it would enable him to dispense with those crops which are less remunerative, and to replace them by others which require a larger dose of manure, but which also yield a larger profit.

On large farms the carting and distribution of dung is attended with much expense, and a considerable saving can be effected by supplying the fields nearest to the homestead with farmyard dung, and those in more remote situations with guano or any other concentrated manure, which admits of a ready distribution.

All means which enable the farmer to supply his fields with a larger quantum of manure than could be the case if entirely dependent on the farmyard, must therefore be regarded as valuable; and the attempts to convert refuse-matters from chemical and other works into fertilisers, for the same reasons deserve much encouragement.

Under the name of artificial manures, however, substances or

mixtures of refuse-matters of the most worthless description are often sold by certain unprincipled dealers at high prices.

These useless compounds are puffed up by such parties with fictitious analyses, testimonials, and high-coloured descriptions of their superior fertilising properties; and the confiding farmer is not only cheated out of the money he pays for such stuffs, but runs likewise the risk of losing part at least of the crop to which he applies them. We cannot wonder, therefore, that many regard artificial manures with a suspicious eye, and must regret that thus the honest manufacturer does not find so ready a market for his products as their value deserves.

Now the only effective means of checking fraud and imposition—of protecting the honest and fair dealer, and guarding against loss and disappointment—is "chemical analysis." Intelligent farmers know this full well, and avail themselves consequently of the advantages which chemistry is capable of conferring. The number of intelligent economical farmers in Scotland, when compared with those of other countries, explains, perhaps, the fact, that in Scotland cases of adulteration and imposition are of rarer occurrence than in the colonies, and even in England.

A single example, which some time ago was brought under my notice, will show to what extent fraud is practised by unprincipled dealers. On examining an artificial manure of a whitish-grey colour, which was offered for sale at £8 per ton, I found no ammonia whatever, and mere traces of phosphoric acid and alkalies; and instead of these more valuable fertilisers, large quantities of carbonate of lime, sand, brick-dust, and a little charcoal. The manure, in fact, I have strong reason to believe, was nothing else than a mixture of dried road-scrapings and charred spent bark.

The determination of the composition of the manure thus becomes the first and chief point to which the chemist directs his attention.

It is clear, however, that a farmer will derive little benefit from the figures in a calculated list of analytical results, if he does not know at the same time how the different constituents act on different crops, and on which of these the chief fertilising properties of the manure depend; how long its beneficial effects are likely to last; and last, though not least, if the actual cost-price of the manure corresponds to its real fertilising value.

Excellent hints on these and other topics are contained in a work, which has lately appeared in Germany, entitled *Chemische Feldpredigten*, (Chemical Field-Sermons,) by Dr Stöckhard, of the Agricultural College of Tharand in Saxony. As this truly practical and useful book is not likely to be read by many farmers in this country, I have thought it advisable to introduce the special examination of bone-manure in its various forms by a short exposition of Dr Stöckhard's views on artificial manures in general. The

merit which attaches to the first part of this paper thus does not belong to me, but to my friend and countryman, Dr Stöckhard.

Before we can possibly answer any of the practical questions which the subject suggests, it is essential to have a clear idea of the composition of the manures, and the relative value of their constituents.

As the most important constituents of artificial manures, we may regard—

1. *Nitrogen*, in the form of ammonia or nitric acid. Nitrogen, without doubt, is the most valuable of all fertilising substances, as it is the cause of the so-called stimulating or forcing property of manures. All cultivated plants are much benefited when richly supplied with it in a proper form, particularly at an early stage of their growth: at a later period of their development its application appears much less effective.

Nitrogen in a free state, however, is not assimilated by plants to any extent, and it is only when the nitrogen of nitrogenised organic matters has become changed by fermentation or putrefaction into ammonia, (or nitric acid,) that this elementary substance acts as a powerful fertiliser. It is for this reason that fresh bones, unfermented urine, long dung, &c., are much slower in their action than the same materials after having undergone fermentation or putrefaction. In the latter state they contain ammonia ready formed, which the plants can assimilate at once; but, in the first case, the decomposition of the nitrogenised matters proceeds slowly in the ground, particularly when ploughed-in deep; and the plants are thus necessitated to wait a long time before they can absorb the ammonia which is generated during the decomposition of the nitrogenised organic matter. In stiff soils, and in dry seasons, the formation of ammonia proceeds so slowly that the beneficial action of manuring substances is often lost in the first year, because, if plants have passed the period of the most vigorous growth, they derive little advantage from the ammonia. On the other hand, manuring substances, such as guano, soot, refuse-water of gas-manufactories, sal-ammoniac, sulphate of ammonia, putrefied liquid manure, which all contain large quantities of ready-formed ammonia, exercise a most surprisingly quick forcing power on grass-land, and on wheat, and all plants at an early stage of their growth.

The effects of ammonia have been so well ascertained by numerous practical experiments, in which it has been applied with the exclusion of all other substances, that few practical men at the present time will hesitate to ascribe the rapid forcing effects of guano, of the ammoniacal liquor of gas-works, &c., to the ammonia which they contain.

In the form of nitric acid, nitrogen becomes also a most valuable manure, and in this state it closely resembles in its action ammonia. The effects of nitrate of soda, for instance, on grass-

land, are strikingly exhibited by the succulent luxuriant appearance and the deep-green colour which the grass assumes shortly after the application of even small quantities of it.

Nitrates thus appear to exercise the same forcing power on plants as ammoniacal salts. It is indeed doubtful whether nitrogen, in the form of ammonia or nitric acid, is most beneficial to vegetation; and as the determination of this point has a direct bearing on the management of farmyard manure, I would suggest to practical men, who may be inclined to confer some good on the agricultural community, the propriety of determining the relative effects of nitrates and ammoniacal salts by a series of comparative field experiments.

2. *Phosphoric acid.*—Next to ammonia, phosphoric acid must be regarded as the most valuable compound in artificial manures. It occurs in soils but in small quantities, and as it is an essential constituent of all cultivated plants, and particularly required for the perfection of grain, its deficiency in the soil is at once indicated by the poor small ears of wheat, oats, or barley. Phosphoric acid exists generally in artificial manures in the form of bone-earth or phosphate of lime.

3. *Alkalies—potash and soda.*—Other valuable fertilisers are potash and soda, or rather salts of potash or soda, particularly the first. In their chemical relations, potash and soda resemble ammonia; and this similarity is also shown in their action, which, like that of ammonia, is forcing or stimulating.

All cultivated plants, particularly root-crops and herbaceous plants, require potash as a necessary article of food, for they show in their ashes large quantities of it. It is for this reason that turnips, carrots, and other green crops, are much benefited by the application of burnt clay, in which, as I have shown in this Journal some time ago, a much larger quantity of soluble potash exists than in natural clay. For the same reasons these crops are much benefited by wood-ashes and liquid manure, which both contain considerable quantities of salts of potash.

The salts of soda are of less importance in a manure. Most soils in this country will be found to contain a sufficient quantity of soda, chiefly in the form of common salt, for supplying plants with this ingredient, which, though it preponderates usually in the soil over potash, is nevertheless found in the ashes of plants in much smaller quantities than potash.

4. *Lime and magnesia.*—Lime and magnesia are indispensable for the healthy growth of plants; but as both belong to the most generally distributed mineral substances on the earth, the farmer can easily supply a deficiency of lime or magnesia in his soil, by the application of quicklime, marl, gypsum, chalk, or similar substances containing lime, which may now be obtained almost anywhere in this country at moderate prices.

5. *Organic substances, humus.*—Although the decayed organic

matters or the humus of a soil play an important part in relation to the growth of plants, the farmer need not care to supply his land directly with humus, as, under good management, Nature herself provides for the necessary quantity of humus in a soil. Organic matters, consisting of carbon, hydrogen, and oxygen only, are of far less importance than the nitrogenised matters. The latter, we have seen, furnish on their decay ammonia, whilst the former, or humus substances, furnish, on gradual decomposition, carbonic acid and water only, which the atmosphere supplies abundantly to plants. In artificial manures, organic matters consisting of carbon, hydrogen, and oxygen only, are not very valuable substances.

6. *Silica*, *oxide of iron*, *sulphuric acid*, *chlorine*, enter likewise into the composition of the ashes of all cultivated plants, and are therefore essential articles of food for them. But as there are few soils which do not contain these substances abundantly, the farmer has no need to buy them.

It will thus appear that nitrogen (or rather ammonia and nitric acid) is the most valuable ingredient of artificial manures, because our fields are generally deficient in it, and because farmyard manure does not contain a quantity sufficiently large to bring the land to its maximum state of fertility. Another reason for the value of nitrogenised matters (or ammonia) is their costliness, and the fact, confirmed by numerous practical experiments, that the mineral matters of manure only show their full fertilising effects when decaying nitrogenised matters, or salts of ammonia, are present at the same time.

Next in value follow phosphoric acid and potash, as both belong to the rarest of the mineral matters which serve as food to plants, and as both are required for their healthy growth in larger quantities than any of the other constituents which are usually found in the ashes of plants.

How soon does an artificial manure act?—Chemical analysis, in many instances, is capable of satisfactorily answering this question. Those constituents of an artificial manure which are soluble in water, or which are easily rendered so by a rapid decomposition, benefit plants in the first year; those which are soluble in acids, or which decompose more slowly in the ground, exercise the chief fertilising action on plants in the second or third year; those, finally, which are insoluble in acids, or which decompose still more slowly, can only benefit vegetation at a still more remote period.

It is well, therefore, to arrange the constituents of an artificial manure under three heads:—

1. Substances soluble in water.
2. Ditto in acids.
3. Substances insoluble in water and acids.

Such an arrangement of the analytical results will frequently enable the farmer to form an idea of the probable action and duration of the manure. Exceptions to this general rule are presented to us by all those matters which consist entirely of undecomposed animal or vegetable matters, and which are rendered soluble, or available to the use of plants, by previous decay or putrefaction. Rape-cake, bones, and woollen rags, for instance, contain scarcely any soluble matter, and nevertheless it would be very erroneous to consider them as slow-acting manures. In all such cases practical experiment alone can decide the question. Experience, then, proves that rape-cake is readily decomposed, bones more slowly, and woollen rags still slower.

By dissolving bones in sulphuric acid, their full action, which in unprepared bones is confined principally to the second or third year of their application to the land, is obtained in the first year.

How are artificial manures best applied to the land? In what state? At what time? In what quantities?—Practice alone can give correct answers to these questions. Theory in many instances may throw out some valuable hints, but can never give special directions, as the nature of the soil, the position of the land, the climate, and numerous other local influences, necessarily must greatly alter the mode of application of artificial manures. The best mode of application is entirely dependent on circumstances, and can only be established in every separate instance by practical experience.

What is the value of an artificial manure?—This question, undoubtedly, is the most important to the farmer, and happily one the solution of which chemistry will greatly facilitate.

The external characters are insufficient indications of the real value of an artificial manure: a much better guide to the correct estimation of its value is chemical analysis. The farmer, however, will derive benefit from analysis only, when he can calculate from the analytical data the money-value in an easy manner. In order to enable him to do so, he requires to know the market price of each of the constituents of the manure. By a simple rule of three he can then ascertain the value of the whole manure.

Calculations of this description, however, are not so simple as they might appear to be, and often present insuperable difficulties, arising from the want of a standard price of several of the constituents of artificial manures. Many of them are not found in trade at all; others, like potash, soda, sulphuric acid, &c., which are articles of commerce, are always sold in a more or less purified state; but it is clear that the commercial value of such materials cannot be accepted as the standard price, because the value of an artificial manure, in which the same substances occur in an impure state, would be estimated far too high. A third difficulty in ascertain-

ing the commercial value of manuring substances arises from the circumstance that two, three, or four simple substances occur together, in the fertilisers of commerce, which renders it very difficult to assign to each its proper value.

It would lead me too far to enumerate all the reasons which could be assigned for fixing the price of some of the more frequently occurring manuring substances which follow. However useful the subjoined Table may be to the practical man, considerable latitude must be allowed in estimating the real commercial value of an artificial manure; and as all articles of commerce are subject to considerable fluctuations, it follows, necessarily, that the price-list subjoined can have no permanent value.

TABLE FOR DETERMINING THE VALUE OF ARTIFICIAL MANURES.

1. Every lb. of nitrogen, in the form of ammonia, or nitric acid, may be estimated at	8d.
2. 1 lb of nitrogen, in the form of nitrogenised matters, at	6d.
3. Organic matters, free from nitrogen, (humus,) 18 lb., at	1d.
4. Salts of potash, 1 lb., at	1d.
Or potash separately, 1 lb., at	1½d.
5. Salts of soda, 9 lb., at	1d.
6. Phosphate of lime, 1 lb., at	¾d.
Or phosphoric acid, separately, 1 lb., at	1½d.
7. Gypsum, 6 lb., at	1d.
8. Lime, 12 lb., at	1d.

For all practical purposes, the determination of the value of the remainder of the substances, which are usually indicated in the analyses of artificial manures, such as oxide of iron, alumina, silica, &c., may be entirely neglected.

The chief questions which the farmer requires to have answered by the chemist, are—

a. How much, in 100 lb., does the artificial manure contain of —1. Nitrogen; 2. Organised substances; 3. Salts of potash; 4. Salts of soda; 5. Phosphate of lime; 6. Gypsum; 7. Carbonate of lime, or of magnesia?

b. In what combination does the nitrogen exist? In the form of ammoniacal salts? Or in the form of nitrates? Or in the form of nitrogenised organic matters? Do the latter enter easily into putrefaction, or do they decompose with difficulty?

The answer to the first question *a*, including the above-mentioned seven points, will enable the farmer to calculate the commercial value of the manure. The answers to the other questions, *b*, will teach him approximately whether the manure is likely to act quickly, or whether it belongs to those the full fertilising effects of which are brought out only in the second or third year.

Before I proceed to the second part of this paper, which refers to the composition of bone-manure, I shall give the following list

of the more generally occurring artificial manures, taken from page 59 of the work above mentioned.

In this list the artificial manuring substances are arranged according to their action and composition, in an order which begins with the most powerful, and ends with the weakest manure. Some of the materials occur under several heads, which is an indication that they contain more than one chemical compound, and therefore act in more than one way.

TABLE of ARTIFICIAL MANURES, arranged according to their Action and Chemical Composition.

1. *Nitrogenised manures.* *(Forcing manures.)*

a. Substances containing Ammonia. (Very quick-acting manures.)
Ammoniacal salts.
Peruvian guano ; soot.
Putrid animal substances—for instance, blood, flesh, wool.
Ammoniacal water of gas-works.
Putrid urine ; putrid liquid manure.
Short dung—particularly sheep and horse-dung.

b. Nitrogenised matters, which pass easily into putrefaction. (Tolerably quick in their action.)
Horn-shavings ; glue.
Bones—dissolved, steamed, or finely powdered.
Oilcakes of all kinds ; malt-dust.
Fresh urine, fresh liquid manure.

c. Nitrogenised matters, which decompose with difficulty. (Slowly-acting forcing manures.)
Half-inch bones.
Woollen rags.
Long dung.

d. Substances containing nitric acid. (Quick-acting forcing manures.)
Saltpetre.
Chili saltpetre, (nitrate of soda.)
Nitre—earth.

2. *Carbonaceous manures.* *(Humus forcing manures.)*
Common farmyard dung ; straw, leaves of trees, &c.
Sawdust ; green manures.
Peat, or vegetable remains of all kinds.

3. *Manures containing much potash.* *(Strongly-forcing manures.)*
Potash, nitre, malt-dust.
Urine, wood-ashes.
Leaves and green manures.
Road-scrapings, compost.
Burnt clay ; some kinds of marl.

4. *Manures containing principally soda.* *(Less effective manures.)*
Common salt.
Nitrate of soda, urine.
Several minerals.
Soap-boilers' refuse.

5. *Phosphatic manures.* *(Grain or seed-forcing manures.)*
Burnt bones, animal black, refuse of sugar manufactories.
Phosphorite, apatite, coprolites.

Saldanha Bay guano.
Fresh bones, bone-dust.
All sorts of guano.
Animal matters of all descriptions.
Oilcakes ; malt-refuse.
Human excrements, farmyard manure.
Urine of carnivorous animals.
Wood-ashes, straw, leaves, &c.

6. *Manuring matters containing sulphuric acid. (Partly manures themselves, partly fixers of ammonia.)*
Gypsum, sulphuric acid.
Green vitriol.
Coal-ashes, peat-ashes.

7. *Calcareous manures.*
Burnt lime, chalk, marl.
Gypsum, coal and peat ashes.
Road-scrapings, gas-lime.

8. *Siliceous manures.*
Coal-ashes, peat-ashes.
Farmyard manure, sand, straw, &c.

After these general remarks on artificial manures, I shall now proceed to state the results of analyses of the several forms in which bones are usually applied as a manure, and shall make, at the same time, a few observations respecting the most profitable manner of applying this valuable manure to the land.

The forms in which bones are usually applied to the land are, ½ and ¼ inch bones, bone-dust, fermented bones, boiled bones, steamed bones, (Blackhall's process,) dissolved bones, (superphosphate.)

Although bones of different animals have been repeatedly analysed, we do not possess a sufficient number of analyses of ½ and ¼ inch bones and bone-dust to determine what the average composition of commercial bone-dust ought to be. I procured, therefore, bone-dust from different localities, and subjected it to chemical analysis.

The first specimens analysed were obtained from Mr Slater's bone-mill, Cirencester. The following are the analytical results:—

	No. I. ½ inch bones.	No. II. ¼ inch bones.
Moisture,	18.12	13.58
Organic matters, (gelatine and fat,)	29.29	33.69
Phosphate of lime and magnesia, (bone-earth)	44.22	42.77
Carbonate of lime,	5.49	7.04
Alkaline salts, (chiefly common salt,)	1.49	2.00
Sand,	1.39	0.92
	100.00	100.00

15.27 grs. of bones, No. II., dried at 220° F., burned with soda-lime, gave 12.06 of bichloride of platinum and ammonium ; or 100 lb. of dried bones contain nitrogen 4.96, which is equal to 6.02 of ammonia. 100 lb. of these bones, in their natural state,

consequently contain nitrogen 4.28 = 5.23 of ammonia. The price of these bones was 18s. per quarter. The weight per bushel, on an average, was 42 lb.

Previous to crushing they had undergone no preparation whatever. How nearly the real commercial value of these bones corresponds with the theoretical value, which by means of the above table can be easily calculated, will be seen by the following statement, which we give as an example :—

	In 100 lb.	s.	d.
Nitrogen, 6d. per lb.,	4.28	2	1½
Organic matter, 1d. per 18 lb.,	33½	0	1½
Phosphates, ¾d. per lb.,	42¾	2	8
Alkaline salts and lime,	—	0	1

Price per 100 lb., calculated, 5s.; actual price per 100 lb., 5s. 4d.

Quarter and Half inch Bones, from another Bone-mill in the neighbourhood of Cirencester.

	No. I. ¼ inch.	No. II. ½ inch.
Moisture,	17.00	16.42
Organic matters, (gelatine and fat,)	30.54	26.64
Phosphate of lime and magnesia, (bone-earth,)	34.41	49.78
Carbonate of lime,	8.56	6.51
Alkaline salts,	2.56	1.17
Sand and earth,	6.98	—
	100.05	100.52

20 grs. of bones, No. II., dried at 220° F., burned with soda-lime, gave 13.52 grains of bichloride of platinum and ammonium; or, 100 parts contained nitrogen 4.12, equal to 5.0 of ammonia. These bones, in their natural state, accordingly contain nitrogen 3.43, equal to 4.18 of ammonia.

Before crushing, they had been boiled in an open boiler for a short time, for the purpose of extracting the fat. Along with the fat the gelatine appears to have been partially dissolved, which accounts for the lower percentage of nitrogen which these bones contain. A comparison with the preceding will show that they are of a much inferior quality. No. I. evidently is adulterated with sand and earth.

Half-inch Bones from Magee's Bone-works at Runcorn near Liverpool.

Moisture,	9.46
Organic matters, (gelatine and fat,)	29.20
Phosphate of lime and magnesia, (bone-earth,)	52.06
Carbonate of lime,	6.11
Alkaline salts,	2.88
Sand,	0.17
	99.88

20.96 grs., dried at 230° F., gave 5.94 grs. of metallic platinum, or 100 parts contained nitrogen, 4.0, equal to 4.85 of ammonia. 100 lb. of natural bones thus contained nitrogen 3.62, or 4.39 of ammonia.

It will be observed that the proportion of moisture is considerably less than in the preceding samples, and the proportion of bone-phosphate higher, which renders them more valuable in as far as the bone-phosphate is concerned. The actual price at Liverpool is £6 in quantities, and £6, 10s. for small orders per ton.

Commercial Half-inch Bones, obtained from Charles Lawrence, Esq., Cirencester.

	No. I.	No. II.
Moisture,	13.18	13.36
Organic matter, (gelatine and fat,)	27.92	28.32
Phosphate of lime and magnesia, (bone-earth,)	48.24	48.49
Carbonate of lime,	9.66	8.10
Alkaline salts,	1.62	2.18
	100.62	100.45

(1.) 13.35 grs. of No. I., dried at 220° F., gave 7.81 bichloride of platinum and ammonium; or, 100 parts of dried bones contained nitrogen 3.70 = 4·49 of ammonia. 100 lb. in the natural state thus contain nitrogen 3.21 = 3·89 of ammonia.

(2.) 16.62 grs. of No. II., dried at 220° F., gave 10.54 of bichloride of platinum and ammonium; or, 100 lb. of dried bones contained nitrogen 3.98 = 4.83 of ammonia. 100 lb. of natural bones accordingly contain nitrogen 3.45 = 4.18 of ammonia.

The composition of these two samples of bones, it thus appears, is nearly identical; but as one of the samples was considerably heavier than the other, a material saving would be realised by buying it by measure, and not by weight, supposing the price per bushel to be the same for each.

Quarter and Half-inch Bones from Leith.

	No. I. ¼ inch.	No. II. ½ inch.
Moisture,	9.82	11.17
Organic matter, (gelatine and fat,)	37.50	34.95
Phosphate of lime and magnesia, (bone-earth,)	45.66	47.50
Carbonate of lime,	5.23	4.53
Alkaline salts,	1.96	1.61
	100.17	99.76

(1.) 17.35 grs. of No. I., dried at 220° F., gave 12.71 grs. of bichloride of platinum and ammonium; or, 100 lb. gave nitrogen 4.60 = 5.58 of ammonia. 100 lb. of natural bones thus contain nitrogen 4.15 = 5.03 of ammonia.

(2.) 19.89 grs. of No. II., dried at 220° F., gave 14.95 of bichloride of platinum and ammonium; or, 100 lb. of dried bones contain nitrogen 4.72 = 5·73 of ammonia. 100 lb. of bones in their natural state thus contain nitrogen 4.18 = 5.08 of ammonia.

These two samples of bones likewise resemble each other closely in composition. They contain nearly 1 per cent of nitrogen more than the preceding samples, and are, therefore, superior in quality.

The actual price at Leith of No. I. is 16s. 9d. per quarter; of No. II., 16s. 6d. per quarter.

It will appear from these analyses that commercial bone-dust differs considerably in composition; that in some bone-mills the raw bones are boiled previous to crushing, for the purpose of extracting the fat; and, lastly, that bone-dust is occasionally adulterated with sand and earthy matters. The practice of extracting the fat has the disadvantage that some of the valuable gelatine is extracted as well, which appears clearly from the smaller proportion of nitrogen which some of the above analyses exhibit.

The fertilising properties of bones depend on the amount of gelatine (nitrogen) and of bone-earth (phosphoric acid and lime) which they contain. Both the organic portion (gelatine) and the inorganic part (bone-earth) are valuable fertilisers, and it is, therefore, an unpardonable waste to destroy the gelatine by burning. This practice, which has been recommended for the purpose of reducing the bones more easily to powder, deserves to be condemned unconditionally, because there are other means of reducing bones effectually to powder without destroying so valuable a material as gelatine undoubtedly is.

Bone-dust resembles, in its chief constituents, the solid excrements of animals, and straw, and differs from them chiefly by being much richer, as will be seen by the following comparison:—

Constituents.	1000 lb. of bone-dust.	1000 lb. of fresh cow or horse dung.	1000 lb. of dry straw.
Nitrogen, . .	50	4	4
Phosphoric acid,	240	3	2
Lime, ...	330	4	4

Bone-dust thus contains about twelve times more forcing substances, and eighty to a hundred times more grain-forming materials, than dry straw or the solid excrements of animals.

With regard to the application of bone-dust, I would observe, that the usual practice of applying bones, as ½ inch or ¼ inch bones, cannot be recommended. In this state they decompose very slowly in the ground—so slowly, indeed, that ten or twenty years may be required to dissolve them entirely.

Although gelatine enters very rapidly into putrefaction when exposed to the influences of the atmosphere and water, in the intimate combination in which it exists in bones, gelatine is destroyed very slowly, because phosphate of lime, being almost insoluble in water, protects the interior of the larger pieces of bone from further decomposition, by excluding the air and moisture.

How exceedingly slowly the gelatine of bones is destroyed, will become apparent from the subjoined analyses of Roman bones recently found at Cirencester—

ROMAN BONES FOUND AT CIRENCESTER.

(*a.*) *Lower jaw of an ox, dried* at 212° F.

Organic matter, (gelatine,)	11.77
Inorganic matters, (bone-earth,)	88.23
	100.00

(*b.*) *Molar tooth of an ox.*

Organic matters,	8.41
Inorganic matters, (bone-earth,)	91.59
	100.00

(*c.*) *Tusk of a boar.*

Organic matters,	18.12
Inorganic matters,	81.88
	100.00

(*d.*) *Thigh-bone of a man.*

Organic matters,	13.62
Inorganic matters,	86.38
	100.00

22.8 grs. of *a*, burnt with soda-lime, gave 3.3 of bichloride of platinum and ammonium. 100 parts, therefore, contained nitrogen 0.909.

27.66 of *d* gave 5.53 of bichloride of platinum and ammonium. 100 parts, therefore, contained nitrogen 1.255.

These bones, probably, have been buried in the ground for a period of one thousand five hundred years, and yet they still contain about 1 per cent of nitrogen, corresponding to about 6 per cent of gelatine. They clearly show how slowly bones are decomposed in the soil, and we need not, therefore, be astonished to see sometimes no good result from the application of ½-inch bones, whilst finely-powdered bones act very well. Particularly in heavy clay soils, bones decompose slowly, because the air does not find so ready access as in a more porous soil.

Bone-sawings from Magee's Bone-works at Runcorn near Liverpool.

Moisture,	14.12
Organic matters, (gelatine and fat,)	25.12
Phosphate of lime and magnesia, (bone-earth,)	53.74
Carbonate of lime,	5.39
Alkaline salts,	0.78
Sand,	0.83
	99.98

29.65 grs., dried at 220° F., burnt with soda-lime, gave 8.69 of bichloride of platinum and ammonium; or, 100 parts contained nitrogen 3.82 = 4·64 of ammonia. In their natural state, consequently, 100 lb. contained nitrogen 3.28 = 3.98 of ammonia.

These sawings constituted a very fine powder, which is sold at Liverpool at the rate of £7 to £7, 10s. per ton. Being prepared, in all likelihood, from the more solid bones, which always contain less organic matter than the more cartilaginous ones, we find the percentage of nitrogen rather lower, and the proportion of phosphates rather higher, than in average samples of half-inch bones.

If bones are to be used by themselves, they ought always to be applied in the state of a fine powder, because in this state they are more easily and uniformly distributed on the land, and rendered much more readily available for the use of plants than half-inch bones. There can be little doubt that it will be more advantageous to pay £1 or even £2 more per ton for finely-powdered bones, than to apply half-inch bones at a lower price.

According to the experience of good farmers in Saxony, the total action of 1 cwt. of finely-powdered bones is estimated to be equivalent to 25 to 30 cwt. of farmyard manure. But even in this finely divided state, the full benefit which they are capable of affording is not realised in the first year. Experience has shown that the action of such bones, in a soil which is neither too retentive nor too loose, lasts for about four years, and amounts in the

1st year,	to	25	to	30	per cent.
2d year,	„	25	„	30	„
3d year,	„	20	„	25	„
4th year,	„	10	„	15	„

Boiled Bones from Magee's Bone-Works at Runcorn, near Liverpool.

Moisture,	8.06
Organic matters,	25.45
Phosphates of lime and magnesia, (bone-earth,)	60.48
Carbonate of lime,	3.25
Alkaline salts,	0.43
Sand,	2.56
	100.23

29.41 grains dried at 220° F., burnt with soda-lime, gave 9.59 grains of bichloride of platinum and ammonium; or, 100 parts contain nitrogen 2.004 = 2.433 of ammonia. 100 lb. of the commercial boiled bones, accordingly, contain nitrogen 1.842 = 2.236 of ammonia.

The price of boiled bones at Liverpool is £4 per ton. In the preparation of glue from bones, the latter are boiled with high-pressure steam, which penetrates them, and dissolves all the fat and the greater part of the gelatine or glue. The bones, after cooling, are so brittle that they can be reduced with great facility to the finest powder.

Practical experience has shown that in this form bones act much more rapidly; boiled bones, for this reason, are generally preferred to fresh ones by the farmers of Cheshire, who apply them largely to grass-land with the best results.

It is true, their fertilising effects are not so lasting as those of fresh bones, but they are nevertheless more valuable, as the farmer can do with a smaller quantity, and realises an immediate return for the outlay of capital.

Whilst practice points out boiled bones as the more valuable, theory would seem to mark fresh bones as the more valuable, because the latter contain at least double the quantity of nitrogen, which substance we have described as the most valuable of all fertilisers. But facts are not easily made of no avail by theories; and it remains, therefore, for science to explain this unexpected higher fertilising action of boiled bones.

A little consideration will show that fresh bones can only be acted upon by the atmosphere and water very superficially. On the decomposition of the gelatine of the surface of pieces of bones, the greater part of the phosphate of lime remains behind, which being a substance almost insoluble in water, prevents both the air and the water from acting on the interior. The further decomposition of the bones thus can proceed but very slowly. By boiling bones with high-pressure steam, which thoroughly penetrates the whole mass, all the fat, and the greater part of the gelatine, which separate the particles of bone-earth from each other, are extracted. The whole substance of the bones is thus rendered very porous, and, on account of this porosity, air and water can penetrate the interior of the bones. In consequence of the free access of water and air, a rapid decomposition ensues, whereby much ammonia is formed, which facilitates also the solution of the bone-earth. In an intelligible manner we can thus explain the superior action of boiled bones, and reconcile an apparent contradiction between practice and science.

Steamed Bones.—(Steamed by Mr T. Blackhall's Process.)

I.

		Calculated dry.
Water,	7.32	—
Organic matters,	26.77	28.88
Inorganic matters,	65.91	71.12
	100.00	100.00

II.

		Calculated dry.
Water,	6.91	—
Organic matters, (gelatine,)	26.70	28.68
Phosphate of lime and magnesia, (bone-earth,)	53.74	57.73
Carbonate of lime,	8.65	9.30
Alkaline salts and sand,	4.00	4.29
	100.00	100.00

27.84 grains dried at 220° F., burned with soda-lime, gave 13.93 of bichloride of platinum and ammonium. 100 lb. of dry

steamed bones accordingly contain nitrogen 3.12 = 3.79 of ammonia; or 100 lb. of bones, in a moist state, contain nitrogen 2.90 = 3.54 of ammonia.

Mr Blackhall's process of steaming bones for agricultural purposes is described in the Highland and Agricultural Society's Transactions for January 1850.

It will be observed that these bones contain more nitrogen than the commercial boiled bones. They differ in composition but slightly from fresh bones; and, as they are much quicker in their action, and easily reduced to a fine powder, Mr Blackhall's process cannot be too strongly recommended to farmers.

Having witnessed myself the decided superiority of steamed bones, and being convinced of the great economical value of the process, I have little doubt Mr Blackhall's method of reducing bones will be soon adopted in practice on many farms, as soon as the merits of this process shall be known more generally, and appreciated more fully.

Fossil Bones, or Pseudo-Coprolites, from Walton in Suffolk.

Hygroscopic water,	1.20	
Water of combination, and a trace of organic matter,	3.20	
Oxides of iron and alumina,	4.84	
Lime,	39.81	
Magnesia,	5.68	
Phosphoric acid,	23.48	equal to 47.82 of bone-earth.
Carbonic acid,	5.82	
Insoluble siliceous matter,	12.56	
Alkalies, sulphuric acid, and loss,	2.41	
	99.00	

These fossil bones, or coprolites, as they are falsely called, sometimes are the fossil remains of cetaceous animals. They are very hard, and their reduction to powder, therefore, is rather expensive. The specimens analysed by me are sold on the spot where they are found, at the rate of 28s. per ton. With the expenses for carriage to Cirencester, and crushing, one ton of the finely-powdered material cost about £2, 10s.

That the composition of these fossils is tolerably uniform will appear from the subjoined partial analysis of a sample taken from several tons of the ground material:—

Hygroscopic water,	2.18	
Water of combination, and a little organic matter,	5.28	
Phosphoric acid,	24.26	equal to 49.42 of bone-earth.
Insoluble siliceous matter,	11.05	

It will be observed that these pseudo-coprolites contain mere traces of organic matters. It is for this reason that this manure, when applied alone, does not act as a farming manure like bones. This substance, further, being insoluble in water, ought not to be applied in an unprepared state, but should first be rendered more

soluble, and thus rendered available to plants by digestion with sulphuric acid. The want of nitrogen may then be supplied by guano, or any other artificial manure rich in ammonia.

During 1851, Mr Valentine, the manager of the College farm here, has used a mixture of dissolved coprolites and guano; and as this compound fully realised his expectations, and can be easily prepared on the farm, I would strongly recommend it to those farmers who can procure ground coprolites at a moderate price. The mixture to which I refer is best prepared in the following manner:—

Eight cwt. of ground coprolites are placed in a wooden tub capable of holding at least five times this quantity of the powdered material. The dry powder next is moistened with twenty-four gallons of water, and, after the water has thoroughly moistened every particle of the substance, 160 lb. of concentrated oil of vitriol are added gradually. On the addition of the acid, strong effervescence takes place, in consequence of which the mixture swells very much, and is liable to be thrown out of the tub. It is for this reason that a capacious vat is required for dissolving the substance. When the action of the acid on the powder has ceased, the pasty mass is shovelled out and kept in a heap for a couple of days. After that time it has become much drier, and can now readily be mixed with guano. By mixing two parts of the dissolved coprolites with one part of Peruvian guano, an almost dry powder is obtained, which can easily be sown broadcast or with the manure drill. In point of cost, this mixture is much less expensive than commercial superphosphate of lime; and in point of effect, it is even superior to dissolved bones.

Dissolved bones.—A great many analyses of commercial dissolved bones or superphosphate of lime having been published lately by Dr Anderson and Professor Way, it is not necessary for me to cite many analyses of commercial superphosphate. I shall, therefore, merely give the examination of one sample of superphosphate, as it affords an additional proof of Dr Anderson's observation, that this commercial article is frequently of a very inferior quality.

SUPERPHOSPHATE OF LIME.

Water,	6.30
Organic matters,	9.32
Phosphate of lime,	34.25
Phosphate of iron,	6.57
Sulphate of lime,	28.31
Sulphate of magnesia,	2.42
Sulphate of soda, with a little sulphate of potash,	6.38
Siliceous insoluble matters,	6.45
	100.00

This article, which, in reality, did not contain any soluble phosphate of lime at all, was offered for sale at £7, 10s. per ton.

CLIMATE OF THE BRITISH ISLANDS, IN ITS EFFECT ON CULTIVATION.

By Thomas Rowlandson, C.E., F.G.S., London.

The subject of climate embraces so many important topics, each of which would separately make a tolerably long essay, that it is exceedingly difficult to form such a summary as will give the reader a tolerable knowledge of the various phenomena and meteoric influences whose combined effects are generally understood under the comprehensive term "Climate." Of the primary matters connected with climate, light and heat stand foremost, scarcely subsidiary to which are the subjects of rain, dew, evaporation, winds, &c.: as the latter are determined by the former, they can only be classed amongst secondary objects. To the above, electricity has been added by some. As the effects of this subtile matter on vegetation is little understood, and has only recently been made the subject of inquiry, I shall dismiss the subject with this brief observation—viz., that all the most recent investigations seem to prove that light, heat, electricity, magnetism, and galvanism, appear intimately, if not inseparably, connected, though the laws which govern and modify their action are not understood.

The two great causes which regulate the general climate of the globe are distance from the equator and height above the level of the sea—which are, however, much modified by other circumstances, such as contiguity to large masses of water, snow-covered mountains, prevailing winds, &c. The study of the laws that regulate the variations of the temperature of the atmosphere proves that the sun is the principal cause; in proportion as this body rises above the horizon the heat increases; it diminishes as soon as it is set. The difference between summer and winter depends also on the time that it remains below the horizon, and on its distance from the zenith of the observer.

The height of the sun above the horizon is one of the most important elements in the study of its calorific action. In fact, a surface is more highly heated by a distant source of heat, as the line drawn from this source to the surface approaches nearer to the perpendicular. It has been endeavoured to deduce the changes of temperature of days and seasons from the height of the sun; but the action of this body is modified by so many circumstances, that it can only be ascertained for any particular place by direct experiment, which is done by means of the thermometer.

The following table is constructed, partly by observation, and partly by calculation, of the mean annual temperature for every five degrees of latitude taken at the level of the sea:—

Lat.	Temp.	Lat.	Temp.	Lat.	Temp.	Lat.	Temp.	Lat.	Temp.
0	84°	20	77°8′	40	62°1′	60	44°3′	80	32°6′
5	83.6′	25	74.0	45	57.5	65	40.5	85	31.4
10	82.3	30	70.7	50	52.9	70	37.2	90	31.0
15	80.4	35	66.6	55	48.4	75	34.6		

Being an average diminution from the equator to the north pole of 0.588 of a degree of Fahrenheit for every degree of latitude. The diminution is, however, rather greater between the parallels 50° and 60°, within which are comprised the main part of the British islands: between these points the average decrease is 0.86 of temperature for every degree of latitude; between the 50th and 55th parallels (the greater part of South Britain) the diminution is 0.9 for every degree of latitude, being 0.312 of a degree above the average; whilst between the 50th and 60th it is only 0.232 in passing northwards. Nearly the whole of North Britain lies between the two last-named parallels. So far as the British Islands are concerned, the above table may be pretty well relied on for practical purposes. In consequence of the temperature of different places in the same latitude varying, there has lately been constructed maps having what are termed isothermal lines (lines of equal heat) delineated thereon.*

The isothermal of 10° centigrade† cuts the west coast of America at the mouth of the Columbus (Fort George, lat. 46° 18′, temp. 10° 1′; Fort Vancouver, lat. 45° 36′ N., temp. 11° 5′,‡) descends towards the south, traverses the north part of the State of Ohio, and reaches near New York (Kingston, New York, lat. 41° 55′, temp. 10°; North Salem, lat. 41° 20′, temp. 8° 9′.) Here the isothermal presents a great convexity towards the equator; then it rises abruptly towards the north, passes in the neighbourhood of London, (lat. 51° 31′, temp. 10° 4′; Dublin, lat. 53° 21′, temp. 9° 5′.) This is the highest latitude that this isothermal attains, for it then falls towards the south, passing through Bohemia, (Prague, lat. 50° 5′, 640 feet above the sea, temp. 9° 5′;§ Dresden, lat. 51° 3′; height, 384 feet; temp. 8° 5′,‖) the north part of the Black Sea (Nicolaiiff, lat. 46° 58′, temp. 9° 3′; Sebastapol, lat. 44° 35′, temp.

* For example, Johnston's magnificent Atlas, published by Messrs Blackwood.

† To reduce the centigrade degrees to those of Fahrenheit, multiply by 1.8 and add 32 to the product. Thus London, lat. 51° 31′, temp. 10.4; centigrade formula, 19.4 × 1.8 = 18.72 + 32° = 50.72. Dublin, 53° 21′, temp. 9.5; formula 9.5 + 1.8 =17.1 + 32 = 49° 1′.

‡ All these temperatures are centigrade, and can be calculated by the formula above quoted.

§ 49°.1′ Fahrenheit, to which 2 degrees ought to be added for the height above the sea.

‖ 47° 3′ Fahrenheit, to which should be added 1° 3′ on account of altitude. The effects of altitude on temperature will be explained subsequently.

11° 5'.) This isothermal probably cuts the sea-coast of Asia at the north of the isle of Nipon.

The isothermal of 5° centigrade (41° Fahrenheit) cuts the west coast of America at the north of New Archangel, on the isle of Silcha (lat. 57°, temp. 7° 1'.) Yet it seems to come from the south, for Iloulouk, on the isle of Ounalaschka, and in lat. 53° 53' appears to have a temperature of only 4°. It then descends towards the south, cuts Lake Michigan (Fort Brady, lat. 46° 39', height 590 feet, temp. 4° 9',) and the west coast of America, in the State of Maine (Eastport, lat. 44° 54', temp. 5° 4'; Halifax, lat. 40° 44', temp. 6° 2'.) It then traverses the south part of Newfoundland, passes the north of the Feröe Isles, cuts the Norwegian coast as high up as Drontheim (lat. 63° 26', temp. 4° 5'.) As soon as it has traversed the Scandinavian Alps, it descends towards the south-east, passes to the north of Christiana (temp. 5° 4',) and Stockholm (temp. 5° 6',) to the south of Kasan and Moscow, and reaches the coast of Asia in the midst of the chain of the Kuriles.

Elevation has the same effect upon temperature as distance from the equator: in proportion as we ascend a mountain, it is found that the temperature falls. The law according to which temperature decreases, as to the limits of the atmosphere, is yet unknown; no great error, however, will be committed in admitting that the same differences of level correspond to the same differences of temperature. It is customary in England to calculate a fall of one degree of the thermometer for every hundred yards of elevation: for practical agricultural purposes, this formula will be found sufficient. Before leaving this part of the subject, it may be remarked, that long series of observation, made by De Saussure and Kaemtz at great distances and differences of level, on the Rigi, Col de Géant, Geneva, Chamouni, &c., show that the decrease varies with the season and the hour of the day. From tables of these observations, it would appear that about five in the morning is the time when this decrease of temperature, in ascending mountains, is most rapid, and towards sunset it is slowest.

With regard to the diminution of temperature which takes place on ascending mountains, it must be remarked, that if the land is only slightly elevated, or the country is composed of successive steps or extended plateaus, the decrease of temperature is much less than on the side of abrupt mountains: the difference between the two cases probably amounting to not less than twenty-five per cent. In passing from south to north, the mean temperature of Great Britain may be taken to decrease one degree of Fahrenheit for every 80 miles; and the same decrease in temperature takes place for every 300 feet of elevation. On viewing the temperature of different places, discordant results will appear. On a careful examination, it will, however, be discovered that these discrepancies are to be accounted for by local causes, many of

which will be subsequently noticed. The following table will pretty clearly show the gradual increase of winter cold, in passing from south to north, and also the diminution of summer temperature.

SUMMER AND WINTER MEANS IN THE BRITISH ISLES.

PLACES.	Winter.	Summer.	Difference.
Feröe, ...	39°2′	52°88′	13°76′
Unst, (Shetland,)	39.29	53.456	14.166
Isle of Man, ...	42.62	59.144	16.524
Edinburgh, ...	58.246	57.326	19.08
Aberdeen, ...	38.102	58.226	20.124
Kinfauns Castle, . . .	37.292	57.506	20.214
London, ...	37.796	62.150	24.354
Lancaster, ...	38.444	59.576	21.132
Kendal, ...	35.654	57.776	22.122
Penzance, ...	44.672	60.494	15.822
Helston, ...	43.142	60.000	16.858

In all these places the mean temperature of winter is above the freezing-point. Even in the Shetland and the Feröe Isles, at 62° of north latitude, the winter mean is higher than that of London, but the summers are colder, and the variations between the two seasons scarcely amount to 14°. Only a slight difference is also shown at Penzance and Helston in Cornwall, whilst London, on the east part of the island, presents a difference of 24° 3′. The difference of winter temperature between the west and east coasts of the island will be explained when the subjects of evaporation, rain, and dew are taken into consideration: it may, however, be here briefly remarked, that the mildness of winters on the western coasts and islands is due to the precipitation of vapour, brought up by the prevailing southerly and south-westerly winds. By way of making the subject better understood, we will here insert three tables of the mean winter and summer temperatures of different parts of the Continent. The degrees of these tables are by the centigrade thermometer.*

SUMMER AND WINTER MEANS IN FRANCE AND HOLLAND.

PLACES.	Winter.	Summer.	Difference.
Amsterdam, ...	2°67′	18°79′	16°12′
Middleburg, ...	1.92	16.92	15.00
Maestricht, ...	2.84	18.12	15.28
Brussels, ...	2.56	19.04	16.45
Franeeker, ...	2.56	19.57	17.01
The Hague, ...	3.46	18.63	15.17
Saint Malo, ...	5.67	18.90	13.23
Dunkirk, ...	3.56	17.68	14.12
La Rochelle, ...	4.78	19.22	14.44
Paris, ...	3.59	18.01	14.42
Montmorency, ...	3.21	18.96	15.75

* See foot-note † on page 267.

These different cities enjoy a mean winter temperature of about 3° C., like that of England—Penzance and the neighbouring part of the West of England excepted. This is an effect of the continental east winds, which maintain the serenity of the sky. The difference between summer and winter, which in England only amounts to 13° C., is raised to 15° C. on the Continent.

SUMMER AND WINTER MEANS IN GERMANY.

PLACES.	Winter.	Summer.	Difference.
Danzig,	— 1°11′	16°62′	17°83′
Bayreuth,	— 1.20	16.03	17.23
Berlin,	— 1.01	17.18	18.19
Augsburg,	— 1.08	16.80	17.88
Apenrade,	— 0.73	16.21	15.48
Dresden,	— 1.20	17.21	18.41
Cuxhaven,	— 0.51	16.76	16.25
Tubingen,	— 0.02	17.01	17.03
Sagan,	— 2.65	18.20	20.85
Munich,	— 0.12	17.96	17.84
Ratisbon,	— 1.93	19.68	21.61
Hamburg,	— 0.40	18.96	18.56
Lunenburg,	— 0.95	17.25	16.30
Prague,	— 0.44	19.93	20.37
Vienna,	— 0.18	20.36	20.18

This table presents some anomalies, yet it evidently shows the influence of continents. Notwithstanding the relatively very high latitude of Cuxhaven, Lunenburg, and Apenrade, the mean of the winters is above the freezing-point. This is in consequence of the vicinity of the sea,—counterbalanced, however, by continental influences, which reduce their mean below that of the towns of England situate on the same latitude. In all other parts of Germany, the winter mean is below the freezing point, but the summers are hotter.* In making this comparison, the relative heights above the level of the sea must always be kept in view. It will also be seen that there is an increased difference between the summer and the winter temperature: it is 16° in the west of Germany, in the neighbourhood of the sea, and rises as high as 20° in the eastern part; and at Danzig the influence of the vicinity to the Baltic is feebly felt.

The more we penetrate into the interior of the Continent, the colder do the winters become, and the more does the difference between winter and summer tend to increase, as will be seen by the following table :—

* This will be seen by comparing the tables of England with those of Germany, calculating, as previously noticed, 1° centigrade as equal to 1°8′ of Fahrenheit. The — in the above table means less than the centigrade zero, which is 32°, or the freezing-point of Fahrenheit's scale.

WINTER AND SUMMER TEMPERATURE OF THE INTERIOR OF THE CONTINENT.

PLACES.	Winter.	Summer.	Difference.
Petersburg,	— 8°70′	15°96′	23°66′
Abo,	— 9.79	16.14	21.91
Moscow,	— 10.22	17.55	27.77
Kasan,	— 13.66	17.35	31.11
Barnaul,	— 14.11	16.57	30.68
Hatoust,	— 16.49	16.08	32.57
Irkutsk,	— 17.88	16.00	33.88
Jackoutsk,	— 38.90	17.20	56.10

Whilst in England the thermometer rarely descends 10° below zero,* we find in the interior of the Continent, under almost equal latitudes, a mean of —10° C., (14° Fahrenheit;) and it is not uncommon to see the mercury freeze at Kasan. In the interior of Siberia it often remains solid for several weeks together. The serenity of the sky in these countries favours the radiation of the ground in winter, and its heating in summer, so that the summers are hotter and the winters colder than in England. The difference between the means of the two seasons, which is 23° C. in West Russia, is as great as 33° and even 56° in the interior of that empire; it is therefore four or five times greater than in England.

This law prevails everywhere. The west coast of Norway enjoys a winter relatively very mild, and the mean of which does not differ one-tenth of a degree from that of the summer, but scarcely have we traversed the crest of the Scandinavian Alps than we find a continental climate. The same relations prevail in North America. Whilst the west coast is distinguished by mild winters and cold summers, the difference of seasons is greater in the interior; it then diminishes as we approach the Atlantic. It is always greater than in Europe. This is due to the predominance of west winds, which, as they traverse a great extent of land, communicate to the climate of those countries a continental character. Thus in East America the winters are colder and the summers warmer than they would be were it not for this circumstance.

It was necessary to make this digression from the climate of the British Isles to that of the Continent, in order to give an illustration of the difference of cold between places in the same latitude, but of different longitudes. The observations made in England, to which we have had access, have been principally on the western coast. The general proximity of all parts of the British Isles to the sea, would, in fact, render any deductions made from observations made at places so contiguous as the

* 14° Fahrenheit.

east and west coasts of England of little use, unless they had been continued for a long series of years, by which means a tolerably correct average might have been arrived at. In the absence of such necessary tables, the following may prove interesting:—

MEAN TEMPERATURE OF THE FOLLOWING PLACES.

PLACES.	Latitude.	Height above the sea in feet.	Mean Temperature, (Fahrenheit.) Year.	Winter.	Spring.	Summer.	Autumn.	Coldest month.		Hottest month.		Number of years of observations.
Leadhills, . .	55°25′	1100	43°38′	32°36′	43°52′	55°58′	43°70′	32°36′	Feb.	57°2′	Aug.	10
Dunfermline, .	56.5		45.32	36.68	42.98	55.22	46.04	35.58	Jan.	56.84	July	21
Kendal, . . .	54.17	140	46.94	37.22	45.56	58.10	47.30	34.88	,,	58.82	,,	21
Alderley Rectory,	53.20		46.94	36.86	45.68	57.2	48.02	35.58	,,	57.92	,,	10
Carlisle, . . .	54.54		47.12	37.4	45.56	57.56	47.66	36.14	,,	58.82	,,	24
Edinburgh, . .	55.57	270	47.48	38.48	45.68	57.92	48.02	37.22	,,	59.0–	,,	17
Manchester, .	53.29	140	47.66	37.4	46.22	58.64	48.56	35.58	,,	59.36	,,	25
Dublin, . . .	53.23		49.10	40.28	47.12	59.54	49.64	39.94	,,	60.8	,,	13
Near London, .	51.31	..	49.28	37.58	48.2	61.51	50.00	35.06	,,	63.14	,,	24
Cheltenham, .	51.55	..	49.46	38.34	48.56	59.90	50.18	36.86	,,	62.24	,,	13
London, . . .	51.31	..	54.72	39.56	49.10	62.78	51.26	3.74	,,	64.04	,,	40
Lynn Regis, .	50.43	..	50.72	41.9–	48.56	59.36	52.88	40.10	,,	60.44	Aug.	13
Gosport, . . .	50.48	..	51.8	41.0-	50.18	62.78	53.42	39.2	,,	64.04	July	16
Plymouth, . .	50.22		51.98	44.42	50.18	60.8	53.06	42.62	,,	61.88	,,	11
Penzance, . .	50.7		51.98	43.88	49.82	61.7	53.79	42.26	,,	62.96	,,	21

Seeing that the sun is the sole cause of heat, so far as climate is concerned, it might naturally be inferred that the maximum temperature would coincide with the longest day of the year; but such is not the case, as is well known; and the table just given shows that the extremes of heat and cold occur some time after the summer and winter solstices. From the middle of January, the temperature rises at first slowly; then, in April and May, rapidly; it then increases less rapidly until the end of July, when it attains its maximum. It falls, at first slowly, in August; then rapidly in September and October; and descends to its minimum about the middle of January.

The minimum temperature is generally about January 14.

,, mean, ... April 24 and Oct. 21.
,, maximum, . . . July 26.*

In the month of January, when the days commence lengthening,† the sun acts with more force, because its angular height is greater, and it remains longer above the horizon. As the days continue to increase, the earth continues to acquire heat; but the angular height of the sun at first increases slowly, and the heat augments but little. It is only towards the vernal equinox that

* This applies to the mean temperature at the level of the sea. In elevated positions, the greatest heat is in August, and the greatest cold in February.

† There is an old adage, that "the cauld strengthens as the day lengthens."

the temperature rises rapidly: one portion of the heat which the earth receives from the sun during the day is lost by radiation, another portion penetrates to a trifling depth, and another portion warms the atmosphere. By nocturnal radiation, a part of the heat acquired is lost again in space; but the night (during the summer months) being shorter than the day, there is a definite increase of temperature from day to day. Towards the summer solstice, there being little variation in the height of the sun, the increase proceeds only slowly. Although the action of the sun is less energetic in proportion as its height decreases, immediately after the summer solstice, nocturnal radiation is about that time reduced to a mere trifle, on account of the shortness of the night. Each day, therefore, the sun adds a new quantity of heat to that which the earth already possesses, and the mean of the twenty-four hours still goes on increasing; therefore it is that the temperature increases after the summer solstice, so long as the diminution of the days is scarcely sensible; and the maximum occurs at the period when the gain of the day compensates for the losses of the night. It is only when the days decrease rapidly, at the time when the sun is approaching the equator, that the temperature falls. This lowering of temperature would be much more sensible, if the superficial strata of the earth did not restore to the air, by radiation, a portion of the heat which they had borrowed from it during the summer. The diminution continues for some time after the winter solstice, because the loss during the night always detracts from the gain of the day. The radiation of heat from the earth has only a very superficial effect on the temperature of soils. To ascertain the amount, Robert Ferguson, Esq. of Raith, caused a series of large mercurial thermometers, with stems of great length, to be planted in his garden at Abbotshall, about fifty feet above the level of the sea, and nearly a mile from the shore, at Kirkaldy, in lat. 56° 10′. The main part of each stem, having a very narrow bore, had a piece of wider tube joined above it; and, to support the internal pressure of a column of mercury, the bulbs were formed of thick cylinders. The instruments were enclosed for protection in wooden cases, were then sunk beside each other to the depth of *one*, *two*, *four*, and *eight* feet, in a soft, gravelly soil, which changed at four feet below the surface into quicksand, or a bed of sand and water. These thermometers were carefully observed from time to time, and a register kept for nearly three years; from which it appeared that in that situation, on a naked soil, the frost seldom or never penetrates one foot into the soil. The thermometer, at *one* foot, fell to 33° of Fahrenheit, on the 30th December 1815, and remained at the same point till the 12th February 1816; but in the ensuing year it descended no lower than 34°, at which it continued stationary, from the 23d December 1816 to the 1st January 1817. At the same depth of

one foot, it reached the maximum, 58°, on the 13th July 1815; but in the following year it rose only to 54° on the 21st July; and, in the year 1817, it amounted to 50° about the 5th July. This thermometer, in the space of three years, travelled, therefore, over an interval of 25°, attaining its highest and lowest points about three weeks after the solstice of summer and of winter—the medium being 45½.

The thermometer planted at the depth of *two* feet sunk to 36° on the 4th February 1816, but it stood at 38° about the beginning of Januury 1817. It rose to 56° on the 1st August 1815, but in the next year it reached only 53° on the 24th July; and, in 1817, it again reached 56° on the 10th July. At the depth of two feet, the extreme variation was, therefore, 20°, and the maxima and the minima took place about four or five weeks after either solstice.

The thermometer at *four* feet deep had sunk to 39° about the 11th February 1816, and was stationary at 40° near the 3d February 1817. It rose to 54° on the 2d August 1815, and stood at 52° during the greater part of August and September in the years 1816 and 1817. It ranged only 15°, the extreme points occurring nearly two months after either solstice—the mean being 46½°.

The thermometer, whose bulb was planted *eight* feet deep, descended to 42° on the 16th February 1816, but stood at 42½° on the 11th February 1817. It rose to 51½° on the 12th September 1815, fell to 50° on the 14th September 1816, and mounted to 51° on the 20th September 1817. This thermometer had therefore a range of only 9½°, the extremes of heat and cold occurring nearly three months after the summer and winter solstices—the medium temperature being 46¾°.

These observations show how slowly the effects of heat or cold penetrate the soil; and it is presumed, from the preceding observations, that the average rate may be estimated at one inch per day. It will be seen that the thermometers attained their maximum at different periods, though in a tolerably regular succession. The mean temperature of the ground appears rather to increase with the depth; but this anomaly was correctly attributed to the coldness of the two last summers of the experiment, but particularly that of 1816; the thermometer at *one* foot indicating the medium heat of only 43° 8′ during the whole of the year 1816.

The following is a tabulated form of these experiments, exhibiting the mean results of each month, with the exception of those for December 1817, which are supplied from the corresponding month in 1815:—

	One Foot.	Two Feet.	Four Feet.	Eight Feet.	One Foot.	Two Feet.	Four Feet.	Eight Feet.
January,	33°0′	36°3′	40°7′	43°0′	35°6′	38°7′	40°5′	45°1′
February,	33.7	36.–	39.0	42.0	37.0	40.0	41.6	42.7
March,	35.0	36.7	39.6	42.3	39.4	40.2	41.7	42.5
April,	39.7	38.4	41.4	43.8	45.0	42.4	42.6	42.6
May,	44.–	43.3	43.4	44.0	46.8	44.7	44.6	44.2
June,	51.6	50.0	47.1	45.8	51.1	49.4	47.6	47.8
July,	54.0	52.5	50.4	47.7	55.2	55.0	51.4	49.6
August,	50.0	52.5	50.6	49.4	53.4	53.9	52.0	50.0
September,	51.6	51.3	51.8	50.0	53.0	52.7	52.0	50.7
October,	47.0	49.3	49.7	49.6	45.7	49.4	49.4	49.8
November,	40.8	43.8	46.3	45.6	41.0	44.7	47.0	47.6
December,	35.7	40.0	43.0	46.0	37.9	40.8	44.9	46.4
Mean of the whole Year,	43.8	44.1	45.1	46.0	44.9	45.9	46.2	46.6

From a great number of observations, it is found that there is a daily periodical maximum and minimum of temperature. The minimum occurs some little time before the rising of the sun, the maximum about two o'clock in the afternoon—a little sooner in winter, and a little later in summer. This rule, which is only applicable to our climate, varies in different seasons. In autumn and in winter the minimum coincides with a depression of the sun of 18° below the horizon, and in summer of 6° only.

When the sun is above the horizon, it acts upon the earth and the lower strata of the atmosphere with greater power as its angular height is greater. One portion of this heat penetrates the soil, the other is lost by radiation towards the atmosphere and celestial space. Before mid-day the earth receives in every instant of time a quantity of heat exceeding that which it loses by radiation, and its temperature is raised. This effect also continues for some time after the sun has passed the meridian; hence it follows that the maximum takes place some hours after noon. When the sun is sinking towards the horizon, its action becomes less powerful, and the loss by radiation exceeds the gain by absorption. The heat diminishes more rapidly as the sun is nearer setting. As soon as it has disappeared, the calorific source ceasing to have influence, a large portion of the acquired heat radiates towards space, the temperature falls, and would fall still lower if the portion of the heat which had penetrated into the superficial layers of the soil did not return to the surface by virtue of the conducting power of the earth. This lowering of temperature continues until morning, when the returning sun again heats the regions which it illuminates.

It has so far been deemed better to use the ordinary language of

science in describing the causes of some of the most well-known seasonal and diurnal phenomena of climate—to have mixed it up with minute explanations would probably have only mystified it the more to the general reader.

This part of the subject will be more easily understood, by explaining to the reader some of the ordinary and well-recognised properties of heat. Whilst doing so, however, the writer wishes to be distinctly understood that he disclaims taking any part in the controversy whether heat is transmitted by rays or undulation, that is, whether heat is a matter *per se*, or merely a property of matter. He only deals with well-recognised and acknowledged phenomena and effects.

Heat is transmitted by either conduction or radiation. The heat transmitted from the upper part of the soil to the lower, or the reverse, is by conduction, in the same manner as when we place a piece of cold iron on one that is heated to redness. The former will absorb or abstract heat from the latter, until they both become of an equal temperature. The sum of the heat contained in the two pieces, when arrived at an equal temperature, will, however, not be equal to the sum of the heat in the two pieces at the time they were first placed in contact, the difference having evolved, or escaped, by radiation into the surrounding atmosphere. In consequence of the greater affinity of iron for heat, or, in other words, being a better conductor, the two pieces will have become of equal temperature before the surrounding atmosphere is raised to the temperature of the iron, which arises from the circumstance that the atmosphere is a bad or slow conductor of heat. When left a sufficient time surrounded by the atmosphere under proper conditions, the iron and atmosphere will gradually attain an equal temperature. If a piece of hot iron is placed in cold water, the temperature of the two will soon assimilate, water having a great affinity for heat: if the heat is in great excess, the water, or a portion of it, will be converted into vapour, (steam,) the latter circumstance being modified by the pressure of the atmosphere. Water is converted into steam owing to the absorption of heat, which is evolved when again condensed into a fluid. The heat absorbed by the vapour of water, and the excess of heat in water over that contained in ice, is called latent heat. A familiar example of latent heat is exhibited by taking a piece of cold nail-rod iron, and hammering it until it becomes red hot; the condensation of the iron by hammering causes a portion of the latent heat to be evolved and become visible. The conducting power of different substances varies greatly. If on a summer day a mass of metal and a mass of wood, of equal volumes, covered with the same varnish, are exposed to the sun's rays, it will be found that the wood, which is hot on the surface only, will at first give the sensation of a hotter body than the metal; the latter, on the contrary, being deeply

penetrated with the heat, will produce a less intense sensation at first, but it will continue much longer, because it will gradually transmit to the hand all the heat which it has absorbed. For the same reason a piece of metal seems much colder in winter than a piece of wood, because the heat of the hand penetrates much more quickly into the metal than into the wood; only the surface of the latter becomes heated, and this, too, in a very short space of time.

Sand, which is a very bad conductor of heat, is intensely hot on the surface during summer, but at a few inches deep the elevated temperature ceases to exist. Colour has also an effect, heat being absorbed more by substances that are black than those which are white; the former, however, parts with the heat sooner than the latter.

Radiation is the property of emitting heat in straight lines in every direction, and may be regarded as a property common to all matter, varying in degree in different kinds of matter. All bodies in nature are incessantly radiating one to another; hence arises a continual interchange of temperature, because some absorb what the others loose by radiation. It is from the surface of bodies that radiation takes place, and generally with greater facility the less it is polished. These losses are partially compensated by the heat transmitted from within outwards. Covering plants, therefore, with cloth mats or fibrous materials, is only of service as preventing the radiation of heat from the soil, and consequently preventing the lowering of the temperature of the subjacent soil. This subject will be again noticed when the phenomena of the formation of dew comes under consideration.

The preceding explanations will in some degree prepare the reader, who is unacquainted with the general properties of heat, to understand the nature of the phenomena connected with its absorption and evolution, which exercise such powerful effects on the climate of all parts of the earth, and which, in the course of this paper, will have to be continually alluded to.

It is well known that westerly and south-westerly winds commonly prevail in these islands; they are also known to be generally characterised by their moistness, which, according to the season and local circumstances, is shown by the appearances of heavy clouds, mists, and rain. In order to understand the cause of these southerly moist winds, we must refer to what is constantly taking place at the equator.

The regions bordering on the equator are the hottest on the earth, because the sun is at no great distance from their zenith; but setting out from these zones, the temperature goes on diminishing in proportion as we approach the poles. There is, therefore, found an upper current from the equator towards the two poles, and a lower one from the poles to the equator. The air from the poles becomes heated in the neighbourhood of the

equator; it ascends and returns anew towards the extremities of the terrestrial axis. On this principle we ought to find a north wind in the northern hemisphere, and a south wind in the southern, but these two directions continue with the motion of the earth from west to east, and there results a north-east in one hemisphere, and a south-east wind in the other. As the diameter of the parallel circles continues diminishing in proportion as we recede from the equator, and as all the points situated in the same meridian turn round the axis of the earth in twenty-four hours, it follows that they move with a velocity much greater, as they are nearer the equinoctial line. But the masses of air which flow from the north toward the equator have an acquired velocity *less* than that of the region toward which they are directed; they therefore turn more slowly than do the points situated near the equator, and they oppose to the elevated parts of the surface of the globe a resistance analogous to that of a well-defined north-east wind. For the same reason the trade-wind of the southern hemisphere blows from the south-east.

On approaching the equator from the parallel of 30°, few changes are observed in the direction of the winds; they vary from N.N.E. to N.E. or E.N.E., and in the neighbourhood of the equator they are east. As it is at the equator that the motion of the earth's rotation is most rapid, consequently it is there that the masses of air remain most behind-hand and oppose the greatest resistance. It is on this line, also, that the trade-winds from both hemispheres meet; and as one comes from the north-east and the other from the south-east, an east wind is the result—in the same manner that, when one billiard ball is met by another, it takes a direction intermediate between that of the two balls.

In the upper regions of the atmosphere there also exist constant currents. In the northern hemisphere the heated air is determined toward the north; and in proportion as it advances towards the pole, it gets more and more in advance of the earth in its rotatory motion. The combination of this motion from the west towards the east, with the primordial direction from south to north, gives rise to a south-west wind. For the same reason a north-west wind is observed in the upper currents of the southern hemisphere. Having shown the causes why southerly and westerly winds prevail in British latitudes, it remains to account for the variation of winds. On comparing corresponding observations made in many localities throughout Europe, it is easy to recognise that these variations are solely referable to differences of temperature. Suppose, for instance, that a general south-west wind occupies the upper regions, but that the western part of Europe is very hot, while the eastern regions remain very cold, with a cloudy sky: this difference of temperature will immediately give rise to an east wind; and when this wind meets with that from the south-west, there will be a south-east wind, which may be transformed

into a true south wind. These differences of temperature explain the existence of almost all winds. If we suppose that a region is unusually heated, and that there is no prevailing wind, then the cold air will flow in on all sides; and according as the observer is on the north, the east, the south, or the west, he will feel a different wind blowing from the corresponding points of the horizon.

RELATIVE FREQUENCY OF WINDS OUT OF EVERY THOUSAND IN DIFFERENT COUNTRIES.

COUNTRIES.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
England, ...	82	111	99	81	111	225	171	120
France and the Low Countries,	126	140	84	76	117	192	155	110
Germany, ...	84	98	119	87	97	185	198	131
Denmark, ...	65	98	100	129	92	198	161	156
Sweden, ...	102	104	80	110	128	210	159	106
Russia and Hungary, . . .	99	191	81	130	98	143	166	192
North America, ...	96	116	49	108	123	197	101	210

An inspection of the preceding table will show how much the westerly and south-westerly winds prevail in the British Isles. These winds are commonly known as warm winds, in contradistinction to the easterly and north-easterly winds, which in spring are often found to be exceedingly cold.

It has already been shown that the warm current of air which passes from the equator to the poles forms a current in the upper regions of the atmosphere, and is deflected from its direct northern course about the 30th parallel in consequence of its velocity, when it also descends towards the surface of the earth in consequence of its loss of heat, and accompanying condensation of the aqueous particles.

Within the torrid zone a large portion of the heat transmitted by the rays of the sun is absorbed by the waters of the ocean, causing an immense evaporation, thus lowering the temperature of that part of the earth. The rarified air of the torrid zone, together with the aqueous vapour contained in it, becomes gradually cooled, and consequently condensed, in passing into the northern latitudes, thus giving rise to clouds, and eventually to rain. Contemporaneously with this condensation, whether exhibited in the form of cloud or mist, or still more palpably in the shape of rain, heat is being continuously evolved by means of the phenomena now described; a more equable temperature is formed in the various parts of the earth, the fierce rays of a torrid sun being modified by the vaporisation of water and absorption of heat, whilst the colder atmosphere of northern climes is rendered more genial by the heat evolved in the condensation here noticed.

These facts explain the reason why, with few exceptions, the most

rainy districts of the British Islands maintain the most equable temperature throughout the year—viz. by the evolution of caloric—thus warming the atmosphere during the precipitation of rain, which again, in its turn, is partially evaporated, causing an absorption of heat and depression of the temperature.

It must always be understood that, when heat is made sensible, it is given out or evolved; that when cold is produced, heat is being absorbed by the surrounding atmosphere or substances. A familiar illustration of this process is often seen during a thaw: when ice and snow begin to melt, they *absorb* heat from the surrounding medium. Sometimes this absorption is so rapid that the cold produced is sufficient to again reduce the temperature of the atmosphere to the freezing-point, and a short frost supervenes. This will be found to occur more particularly when the thaw is accompanied by a smart dry wind, which causes a rapid evaporation and production of cold. The evaporation in this, as in all other cases, will depend upon two circumstances—the saturation of air with moisture, and the velocity of the motion of the wind. They are in inverse proportion to the former, and in direct proportion to the latter. When the air is dry, vapour ascends in it with great rapidity from every surface capable of affording it, and the energy of this action is greatly promoted by wind, which removes it from the exhaling body as fast as it is formed, and prevents that accumulation which would otherwise arrest the process.

Evaporation increases in a prodigiously rapid ratio with the velocity of the wind, and anything which retards the motion of the latter diminishes the amount of the former. The same surface (according to the late Professor Daniel) which, in a calm state of the air, would exhale 100 parts of moisture, would yield 125 in a moderate breeze, and 150 in a high wind, thus sufficiently accounting for the cold produced when a smart breeze succeeds a fall of rain, and also for the rapidity with which the newly-precipitated moisture disappears.

In connection with climate, another subject has to be taken into consideration, the converse of evaporation—viz. the formation of dew. The formation of dew was most imperfectly understood until Dr Wells published his essay on this subject, which is justly deemed one of the best pieces of inductive reasoning in the English language. In that essay it is clearly shown that dew is attributable to the effects of radiation, which causes a fall of temperature in the strata of air in contact with the soil. When the latter is heated during the day, the vapours rise; and when, towards evening, the force of the ascending current begins to diminish, they fall again to the earth without the air being saturated. After sunset, when the weather is calm and the sky serene, the soil radiates a portion of the heat absorbed during the day, and the temperature descends several degrees below that of the contiguous stratum of air. Thus the same

phenomenon takes place which is observed on the instrument for ascertaining the dew-point, which is referred to below; the grass becomes covered with dew. Dew only appears under a clear sky; a thin stratum of cloud or mist wholly prevents it, in consequence of interrupting the free radiation of heat into space. It is on this account that a small sprinkling of straw, &c., over young plants, at the beginning of the year, prevents the withering effects of frost, because the straw so placed prevents the free radiation of heat from the ground, and thus tends to maintain its normal temperature.

It is well known to agriculturists that nights with heavy dews are very cold; but this cold is the cause, not the effect of dew. Everything which opposes radiation—such as a screen above or beside the object to be protected—prevents the deposition of dew thereon. Plants growing beneath trees are much less wetted than others. Radiation having little intensity when the sky is clouded, there is no dew. It is the same when there is wind, for then the cold stratum of air that is in contact with the soil is replaced, and driven away by others whose temperature is higher.

All circumstances that favour radiation equally contribute to the formation of dew. A body that is a good radiator and bad conductor of heat will, therefore, be covered with a very abundant dew. Thus glass becomes wet sooner than the metals. Organised bodies are wetted more quickly than glass, especially when in small fragments; because, as the heat passes with difficulty from one to the other, that which is lost is not replaced by that which is transmitted from the interior to the surface of the body.

The more moist the air is, all other things being equal, the more considerable is the quantity of dew that falls in a given time; thus, it is entirely wanting in arid deserts, notwithstanding the intensity of nocturnal radiation. In our countries, nights with abundant dews may be considered as foretelling rain, for they prove that the air contains a great quantity of vapour of water, and that it is near the point of saturation. Hoar-frost is frozen dew.

In dull, humid weather, the determination of the dew-point is very important, as indicative of the succeeding weather being fair or dry. Dalton ascertained the dew-point by filling a thin glass vessel with cold spring water; he observed if dew was found upon the outside, and if so, the temperature of the water was too low. Pouring this out, and carefully drying the vessel, he replaced it, having allowed it to regain a little heat from the surrounding atmosphere. These manipulations were repeated until the dew *ceased* to be deposited. He then marked the temperature of the water at the instant dew was deposited on the glass—this was called the dew-point. Professor Daniels constructed a more elaborate instrument, for details of which the reader must be referred to works on

meteorology. The simple process now described is adequate for all the purposes of the agriculturist.

The greatest amount of humidity in the atmosphere in England is between the months of July and September; but from the high mean temperature, and consequent superior powers of the atmosphere for absorbing aqueous vapour during the month of August, dews are not commonly seen until the temperature begins to decrease rapidly in September, at which period of the year the heaviest dews occur. Fogs are composed in the same manner as clouds, being, in fact, aqueous vapour which is invisible during the day in consequence of its greater tension through the continued absorption of solar heat, which, being evolved at night, causes the vapour of water existing in the atmosphere to condense, and form what are termed fogs, when found in the strata of the atmosphere nearest the earth, and clouds when formed in the higher regions. The formation of clouds has been fully explained by Mr Espy in his work on *The Philosophy of Storms*. Without, however, following that gentleman into the general question of storms, we may be permitted to insert his views on the formation of clouds, his explanation being generally admitted as the true *rationale*. "When the air near the surface of the earth becomes more heated, or more highly charged with aqueous vapour, (which is only five-eighths of the specific gravity of atmospheric air,) its equilibrium is unstable, and upmoving columns or streams will be formed. As these columns rise, their upper part will come under less pressure, and the air will therefore expand; as it *expands* it will grow colder (about one degree and a quarter for every one hundred yards of its ascent.) The ascending columns will carry up with them the aqueous vapours which they contain, and if they rise high enough, the *cold* produced by *expansion*, in consequence of diminished pressure, will condense some of the vapour into cloud. The distance in height to which the air will have to ascend, before it will become cold enough to begin to form clouds, is a variable quantity, varying according to the number of degrees which the dew-point is below the temperature of the air;" the mode of ascertaining which has already been described.

It is manifest that, if the air at the surface of the earth should at any time be cooled down a little below the dew-point, it would form a fog, by condensing a small portion of its transparent vapour into little particles of water; and, if it should be cooled twenty degrees below the dew-point, it would condense about three-fourths of its vapour into water. This, however, will not exactly be the case, from the cold produced by expansion in the upmoving columns; for the vapour itself grows thinner, and the dew-point falls about a quarter of a degree for every one hundred yards of ascent.

It follows, then, as the temperature of the air sinks about one

degree and a quarter * for every one hundred yards of ascent, and the dew-point sinks about one quarter of a degree, that, as soon as the column rises as many hundred yards as the complement of the dew-point contains degrees of Fahrenheit, clouds will begin to form; or, in other words, the basis of all clouds, forming by the cold of diminished pressure from upmoving columns of air, will be about as many hundred yards high as the dew-point in degrees is below the temperature of the air at the time.

Such is a brief epitome of the principal phenomena connected with meteorology, which, it is hoped, will be found sufficiently explicit to enable the reader to comprehend the nature of the primary causes which affect our variable climate. Our succeeding observations will be of a more specific and local character.

Increase of winter cold in passing from south to north, and from west to east.—It has been observed, that the increase of winter's cold, in passing from the south to the north, is about one degree of Fahrenheit for every 800 miles of northern latitude. This rule will be found to hold good throughout the British Islands, at the level of the sea, and away from high mountains. From various causes, the increase of winter's cold, in advancing from west to east, appears to have no settled law, in some places the cold being greater in western rather than eastern localities lying under the same parallel of latitude: such is the case at the western part of the North Riding of Yorkshire, in consequence of its proximity to the Cumberland and Westmoreland mountains. Instances of this kind are, however, rare, the rule generally obtaining that the winter's cold increases as we proceed to the eastward. If we compare the mean winter temperature of Cornwall and the western part of South Devon with that of the neighbourhood of London, it will be found that the increase of cold is very rapid, namely, about one degree of Fahrenheit for every twenty-four miles; if the comparison is drawn between the West Devon and the uplands on the borders of Sussex, Kent, and Surrey, the increase will be found still greater—(this remark will hold good though we reduce the temperature to the level of the sea.) In fact, where not otherwise expressed, when stating the relative amount of cold in different places, it must always be understood to relate to the mean level of the sea, calculating 300 feet of elevation equal to a diminution in temperature of one degree on Fahrenheit's scale. The high mean temperature of the west of Devon and Cornwall is owing to its proximity to the sea; the winter temperature of which latter is higher than the mean temperature of that latitude, thus causing the western breezes which commonly prevail to be also of a higher temperature. These winds are also commonly surcharged with vapour

* The decrease of temperature is not so rapid in ascending elevations: this remark only applies to ascending columns of heated air.

of water up to the point of saturation; therefore, when they come in contact with the elevated ridges of Devon and Cornwall, their temperature is diminished, owing to the greater radiation of the land; and vapour of water is thus condensed, accompanied by the evolution of heat, the latter more than compensating for the loss of heat occasioned by radiation. When this condensation proceeds to the point of precipitation, (rain,) a still greater quantity of heat is evolved, which tends still farther to warm the atmosphere. This sensible development of the latent heat of the vapour of water held in the atmosphere during rain is the reason why the atmosphere feels so much warmer after rains. The great amount of rain which falls along the whole of the elevated districts on the west coast of the British Isles would have the effect of raising the temperature of those districts higher than it does, but for one counteracting circumstance, viz. that in districts where the largest quantity of rain falls, there will generally be found to take place the greatest amount of evaporation. As has already been explained, evaporation causes the absorption of heat; by these joint means, an equable temperature is maintained. The late Professor Daniel was the first who somewhat hesitatingly pointed out, that the probable cause of the warmer climate of the west of England was attributable to the evolution of heat consequent on the precipitation of rain. What may justly, at that period, be termed a theory, may now be considered an established fact, admitted by all the most distinguished persons who have studied the subject. The places of greatest winter cold in England are the elevated downs of Surrey, Sussex, and Kent; the uplands extending from Rugby in Warwickshire to Chesterfield and Chapel-en-le-Frith in Derbyshire; and from Much Wenlock in Shropshire to Mansfield in Nottinghamshire. A very cold district also occurs in the vicinity of Alston and Milburn Forest in Cumberland and Durham. The winter's cold in Scotland is very much regulated by the vicinity of high mountains. The increase of cold in winter, in proceeding to the eastward, is not so strongly marked in that country as between the eastern and western coasts of England. This is partly owing to the mountainous character of Scotland, and partly to the circumstance of its being deeply intersected by friths or arms of the sea.

In the absence of registered observations, it would be difficult to point out the parts of Ireland where the lowest winter cold is to be found. The high uplands of Kildare and adjacent parts of the Queen's County, together with Cavan and Armagh, judging from their locality and by personal feeling, we should pronounce the most probable spots where the winters will be found the severest. The rainy parts of the south of Ireland, situate within a curved line drawn from the mouth of the Shannon through the Cummerah Mountains (which separate the counties of Cork and Waterford) to the mouth of the Blackwater near Youghal, enjoy

very mild winters. The whole of Ireland, as compared with the greater part of England, but particularly so when compared with the south-eastern parts of England, enjoys a very mild winter and spring climate.

Different distribution of heat in the various seasons of the year.— The tables already given of temperatures at different seasons of the year will have given the reader some information on this subject. If we compare the temperature of Penzance in the western, and London in the eastern part of England, during various periods of the year, we shall find almost all the phenomena which regulate climates.

Place.	Latitude.	Mean Temperature—(Fahrenheit.)				
		Year.	Winter.	Spring.	Summer.	Autumn.
Near London, .	51°31′	49.28	37.58	48.2	61.51	50.00
Penzance, . .	50°7′	51.98	43.88	49.82	61.7	53.79

Place.	Latitude.	Mean Temperature—(Fahrenheit.)	
		Coldest Weather.	Hottest Weather.
Near London, .	51°31′	35.06 January.	63.14 July.
Penzance, . .	50°7′	42.26 Do.	62.96 Do.

Near London, rather than London, is selected, because it has been ascertained, by a long series of observations made by Luke Howard, that the climate of London is 1.78 of Fahrenheit higher than that of the surrounding country. This is owing to the number of fires, and the breathing of such an immense number of people congregated within such a comparatively small space; the constant clouds of smoke, at the same time, preventing that free radiation which takes place in the open country around it.

In consequence of the prevalence of warm and moist south and south-westerly winds, and the heat evolved by the deposition of this moisture, it will be seen that the winter temperature of Penzance is higher than that of London by 6°30′; the difference between the coldest months at these two places is still greater—viz., 7.2 degrees. In spring, the difference only amounts to 1° 60″, owing partly to the clearer sky in the vicinity of London permitting the direct action of the sun; whilst, in the more cloudy western part of England, the sun's rays reach the soil in a more diffused form, in consequence of the frequent interposition of aqueous vapours. It also generally happens, at this period of the year,

that rapid evaporation is going forward, by which means the temperature of Penzance is depressed. Evaporation also occurs near London, but not to the same extent: first, because a less quantity of rain falls in its vicinity; and, in the second place, in consequence of the impervious character of the London clay, on the one hand, and the pervious nature of the chalk, on the other, comparatively little superficial moisture remains in the soil around London—the impervious character of the clay causing the water to rapidly flow into rivers and streams, whilst on the chalk, on the contrary, the rain-water is with equal facility absorbed by its numerous fissures. Cold produced by the absorption of heat, owing to evaporation, is therefore felt much less in the vicinity of London, than in other places nearly equally circumstanced in all other respects, excepting its geological features. In forming an opinion of the climate of any place, it is therefore necessary to take into consideration local geological circumstances. During the summer months, the direct action of the sun's rays through a less cloudy atmosphere is made remarkably evident—the mean temperature of the summer months being higher in the vicinity of London than at Penzance, by 0°81′ of Fahrenheit; but, according to their relative latitudes, the summer temperature of Penzance ought to be higher than that of London by 1° 2″: thus, the mean difference between the summer temperature of London and Penzance, when reduced to the same latitude, amounts to 2 degrees higher summer temperature at London. In autumn, however, the case is reversed: in June, the sun has reached its northern culmination, but, from causes previously explained, the highest temperature in our latitudes is not reached until some time after the summer solstice. The vapour, therefore, brought from the torrid zone by the northern polar current, on arriving at the projecting coast of the west of England at this period of the year, (the beginning of autumn,) meets and diffuses itself amidst an atmosphere equally saturated with moisture. Whilst the temperature is daily increasing, this vapour is in a great measure held in suspension by the high temperature of the season; when the temperature begins to decline—that is, about the middle or latter end of July—heavy rains frequently occur, accompanied by their constant concomitant, the evolution of the latent heat of the aqueous vapour. The reason why we have so few wet days in summer may be accounted for from the fact that during the summer months the heavy intertropical rains occur, which abstract a large amount of moisture from the upward polar currents. In using the terms summer or winter, as divisions of the year, it ought to be observed that they are not used in the ordinary acceptation of the divisions of the year, but in the way that meteorologists apply those terms—viz., winter consisting of the months of December, January, and February; spring, of March, April, and May; summer, of June,

July, and August; autumn, of September, October, and November.

The clearer sky in the vicinity of London, during the autumnal months, giving rise to a greater radiation of heat than what occurs in the more cloudy district of the west of England, sufficiently accounts for the greater fall of temperature during the autumnal months in the former, over that found to obtain in the latter district.

With respect to the temperature of wet and dry years, Mr Luke Howard, in his work on *The Climate of London*, states:—"I may observe that, although the years 1822, 1825, 1826, and 1827 may be pronounced *warm* and *dry*, yet, on the other hand, 1828 and 1831 are warm and wet, and 1820 and 1829 *cold* and *dry;* the series (thirty-four years) containing, properly speaking, no year that is *cold* and *wet*. Thus the rule of a connection between a high temperature and dryness, on the whole year, may be left to abide the result of a further trial, to be carried on through future seasons. It is important to know that wet years, or seasons, are not accompanied by a low mean temperature."

Different amounts of sensible vapour in fog.—Our sensations tell us that the quantity of water contained in the air is not always the same. Hence it is that in summer we find the heat insupportable in the absence of wind; the air, being saturated with vapour, retards perspiration. If a breeze arises, evaporation from the surface of the skin (perspiration) takes place, the agreeable cooling influence from which is speedily felt. The difference between a moderately dry and a moist cold air is well known to invalids; the latter, though even of a higher temperature than the former, producing a greater chilling effect, in consequence of aqueous vapour having so much greater affinity for heat, as compared with dry atmospheric air. A very dry atmosphere, such as is sometimes produced by north-east winds, excites in most persons very disagreeable sensations, owing to its extreme dryness abstracting an abnormal amount of moisture from the skin. Men, as well as animals, by time become gradually habituated to certain climates. Thus the negro enjoys health in the hot climate of the coast of Africa, which is constantly charged to saturation with moisture. In such situations the European is speedily attacked with fatal diseases, having their principal seat in the liver; whilst, on the other hand, the negro, when transplanted to our northern climes, is equally affected with diseases of the lungs.

The amount of vapour existing in the atmosphere is ascertained by employing instruments termed hygrometers, of which there is to be found a great variety. Whipcord, whalebone, horsehair, catgut, &c., have been variously used: all, however, are more or less inconvenient. The most accurate mode of estimating the

amount of sensible or insensible vapour, or both, is by exposing some substance, such as chloride of calcium, acetate of potash, sulphuric acid, &c., of ascertained weights to a given quantity of air, and weighing the substance employed after such exposure. The *relative* humidity of the atmosphere is, however, most commonly determined by noting the dew-point, and then calculating, from the difference between the dew-point and the temperature, the amount of aqueous vapour present, according to tables constructed for the purpose. Unfortunately, different observers give different data as the amount of the tension of aqueous vapour for similar degrees on the hygrometric scale. The only certain mode is that noticed above, which, however, is not adapted for ordinary use; nor have any extensive experiments been made by this mode, to determine the amount of humidity present in the atmosphere.

In calculating the amount of aqueous vapour present in the atmosphere by ordinary hygrometers, it is also requisite to take into consideration the state of the barometer, as more aqueous vapour will be contained in a given number of cubic feet of atmospheric air, at a given temperature, when the barometer is low, and consequently subjected to less pressure, than when it is high; temperature has also an important influence in determining the amount of aqueous vapour in the atmosphere. In winter, when it is cold, the air is often very moist, whilst the same atmosphere would appear very dry in summer. The greater the difference between the temperature of the dew-point and that of the air, the drier will the air be found. If the dew-point informed us of the *absolute quantity* of the vapour of water contained in the air, the difference between the dew-point and the temperature of the air would indicate the amount of humidity; such, however, is not the case. By this mode, therefore, we can only arrive at relative quantities.

It has been observed by meteorologists that the relative humidity of the atmosphere admits of horary divisions. These differences are connected with either ascending currents of, or with the resistance that the air opposes to, the transference of vapours. When evaporation commences in the morning, with the increase of temperature, the vapour, by virtue of the resistance of the air, accumulates at the surface of the soil. This stratum of vapour does not attain a great thickness; but as soon as the ascending current commences, especially in summer, the vapours are drawn away towards the upper part of the atmosphere with a force that continues until mid-day. The evaporation from the soil is then more active, on account of the increase of temperature; nevertheless, the ascending current diminishes in force, or even ceases altogether. Thus not only does the vapour accumulate in the lower parts, but it even descends from the higher regions; and on this account we observe towards evening a second *maximum*, which is

not sustained, because during the night, the vapour precipitating in the form of dew, or hoar-frost in winter, the air necessarily becomes drier.

This is confirmed by what takes place in mountains; whilst, at a little height, the quantity of vapour diminishes. Towards mid-day, on elevated points, however, a rapid increase takes place in the course of the day, and in the evening a no less rapid diminution. The two phenomena are the more marked as the point is more elevated.

As a general rule, the quantity of sensible and insensible moisture in the atmosphere bears a tolerably fair proportion to the annual rain-fall of any given district. The character of the soil has, however, frequently much to do with it also. Large breadths of stiff clays and marls, by their retention of moisture, cause the superincumbent atmosphere to be almost as saturated with vapour, excepting in dry seasons, as though it were of a marshy character. The deep valleys of the old red sandstones on the borders of England and Wales, the Weald, and many parts of Cornwall and Devon, afford examples of this character.

Bogs, thin soils, and mossy lands, in retentive bottoms, when covering extensive areas, are also liable to have a more humid atmosphere than will be found on drier soils of a neighbouring locality, otherwise similarly circumstanced.

Different degrees of general cloudiness of the sky.—In like manner, as noticed respecting the quantity of sensible and insensible vapour of different localities will the different degrees of cloudiness be found in a great measure to correspond to the annual rain-fall. If cloudy districts are secured from the direct action of the sun, it does not necessarily follow that a district so situated is of an inferior agricultural value. Recent investigations have gone far to prove that the influence of the sun is due to two different causes or sets of rays, the one set being the heating, or red, and analogous rays, the other the chemical, or blue, and analogous rays. The action of the red is supposed to be beneficial, by inducing evaporation of the aqueous particles absorbed by the plant; thus concentrating its inorganic food, and preparing it to be acted on by the blue or chemical ray. The phenomenon here noticed has received the name of Actinism. The theory here named has received some confirmation from the fact, that those who are occupied in taking daguerreotype likenesses have observed that it is difficult to obtain good likenesses in extremely bright sunshine, moderately cloudy weather being best adapted to the purpose.

Mr Robert Hunt, in his *Poetry of Science*, to whom the reader is referred for more interesting particulars, gives a remarkable instance of this. A gentleman going to Mexico procured suitable apparatus for taking daguerreotype impressions. Anticipating, in

the clear bright atmosphere of that country, that he should be enabled to obtain remarkably strong likenesses, his disappointment may be imagined on his finding that the likenesses were much inferior to those taken in his native but more murky atmosphere. It is also a fact well known to horticulturists, that serious damage has been caused to plants, in conservatories and hot-houses, when accidentally exposed to the concentrated rays of certain kinds of flatted glass; plants so exposed being burned and shrivelled up, as though they had been scorched by fire. Rough plate-glass is found to produce no such injurious consequences; whilst the fruit in conservatories so covered is found to ripen as well as in such as are glazed with the more transparent kind of glass. It is a remark often heard in autumn, during a gloomy but warm day, that it (the gloomy day) is a growing or ripening day—an observation of great traditional antiquity, and in some measure appears to be borne out by the recent philosophical investigations just noticed.

If general cloudiness prevents the earth and atmosphere from attaining a high summer temperature, it also prevents the loss of heat at night by radiation, thus maintaining a more equable temperature between the night and the day. A cloudy climate retains the heat obtained from the sun a longer time after sundown, and consequently is sooner heated up to its highest daily temperature, than a cloudless one. These circumstances in a great measure compensate for the less calorific effects of a cloudy atmosphere. The subject will be again reverted to, when the adaptation of climate to vegetation is taken into consideration. So for the present we will pause.

AGRICULTURAL ARCHITECTURE AND ENGINEERING.—No. IV.

By R. S. Burn, M.E., Mem. S.A., Author of "Practical Ventilation," &c.

(*Continued from* p. 212.)

We have now to notice the arrangement and construction of *Chimneys*. This is a most essential part of house construction; but it is one which is too often overlooked, or treated with carelessness or indifference. The same ignorance or want of attention which we know to be observed in the construction of grates, so as to obtain the greatest amount of heat from the least possible quantity of fuel, is as noticeable in the construction of chimneys. Their design is obviously to carry off quickly the products of combustion—to pass these to the open air instead of allowing them to find their way into the apartments; and yet, in almost nine cases out of ten, the construction is so clearly at variance with what the design or

end points out, that the wonder is, to one who understands the subject, not that so many chimneys fail to carry off the smoke, but that so many should succeed in doing so. Empirical rules for regulating their size, situation, and construction, are as varied as they are numerous—each practitioner setting up some standard widely different from that of another, but all dependent for their existence more upon mere ideas or capricious experience, than to the dictates of true science. This state of matters, doubtless, is to a certain extent much modified now-a-days, greater attention being paid to the subject; and instances are not so rare as formerly, when close study of true theory precedes, and dictates to, perfect practice in construction. Nevertheless, with all the progress made, an examination of the methods of daily practice is well calculated to show that we have no great reason to boast of an advancement in this department of the "science of life."

Let us here note, as preliminary to our practical deductions on the subject, the theory on which good practice is based. The mobility of air depends chiefly upon the variations in its density. At the surface of the earth, the pressure of the air on all bodies subjected to it is generally calculated at about 15 lb. per square inch, its density being indicated by about one ounce to the cubic foot. If the pressure is increased to 30 lb. on the square inch, or double that of the ordinary pressure, the density is doubled; and so on in proportion. Now the converse of this rule is what is of importance to our present subject. If the pressure is reduced one-half, the air expands, and the bulk is doubled: the higher the air is above the earth, the less is its pressure and density; as the superincumbent pressure is lessened or decreases, the expansion of the air increases. Now the density of any body of air is lessened by imparting heat to it; in proportion as it rises in temperature, so does it dilate or expand in bulk. Thus, a body of air becoming heated is specifically lighter than the surrounding cold air; it therefore rises, and this at a rate of velocity dependent upon the difference of expansion between the two. From the law, that no two bodies can exist in the same space at the same time, it follows that, as the warm air rises, cold air rushes in from the surrounding space to supply its place; and, on the supposition that this is warmed, it in its turn becomes lessened in density: it thus expands, and in like manner rises; and thus, by heating successive bodies of air, we can command and continue an upward current, the ascensional force of which depends upon the increase of temperature over the surrounding bodies of cold air. It therefore follows that the hotter we can make a body of air, in opposition to that by which it may be surrounded, the faster we can make it expand upwards—just as the lighter the oil, the faster does it ascend in water or other denser fluid. Now, if we have successive bodies of air warmed one after the other—and it is of

importance to facilitate their upward ascent, as the rate of upward velocity depends upon the highness of temperature—it is obviously an erroneous method of procedure to allow the warm air to expand laterally, so as to mix with the surrounding cold air, thus reducing its ascensional force; the true method being to confine the successive bodies of warm air as much as possible, until each reaches the altitude at which it is to be delivered to the common atmosphere. Hence the real service to be performed by chimneys —the smoke and heated air are to be removed from the neighbourhood of the fire as quickly as possible, the upward ascent being facilitated by keeping the bodies of warm air together. The heat is thus retained longer than would otherwise be the case, the ascensional force being accelerated exactly in proportion to the heat of the air—other things being equal.

Smoke, as generally understood, is considered to be lighter than common air. Now this is not the case. Smoke is invisibly heated air, having mechanically combined with it particles of unconsumed fuel, which we call soot; and this soot, which is the visible part of smoke, is in reality heavier than air; but when it is combined with heated air, from the combustion of the fuel, its parts being in themselves of comparative lightness, are easily carried along by the heated current—just as the downy particles of vegetable produce are carried along by light winds, although heavier than air when in a state of quiescence.

Let us now apply these truths to practical purposes;—and first as to the size or diameter of the chimney flue. When chimneys were first introduced, they were, compared to the present size, of enormous dimensions; in fact they formed separate apartments—the fire being in the centre, while seats were placed around it. In process of time, however, as the necessity for increased house comfort was more considered, fireplaces, instead of being confined to the large hall or public room, as was the case when first introduced, were extended to other apartments. Hence arose an absolute necessity of decreasing the dimensions of the chimney in order to have the flues made, without depending upon the thickness of the walls. This reduction of diameter was not, we thus see, dependent upon increased knowledge of the laws governing the ascent of heated air and smoke, but merely as an act of necessity; consequently, as might be expected, the construction of flues was still carried on, without reference to fixed principles.

As a grate or fireplace will produce but a certain quantity of smoke, it is clearly necessary, in order to carry off this smoke quickly, that the tube or flue should be proportioned to this quantity: if too small, the smoke will have a difficulty in gaining access to the external air; if too large, the heated air will be allowed to expand laterally,—its ascensional force will be lessened, and a sluggish current will be produced; and thus less resist-

ance will be offered to its passage upwards. It is a matter of difficulty to decide, with the present knowledge we have on the subject, as to the exact rule to be followed in determining the diameter of a chimney flue for all cases. Much depends upon its shape and situation: thus, a square flue with rough interior retards the ascent of the smoke so much, that an increased strength of current is required, with a given quantity of smoke and equal height of chimney. And the situation of the flue exercises a strong influence on the current; for, if any part of it is horizontal, that causes a proportional decrease in the upward current.

Previous, therefore, to giving a rule as to size of chimney, it will be well to notice both those points just mooted, namely, shape and situation;—and first as to *shape*. Almost all who have studied the subject, are agreed upon the necessity of discarding the square or oblong chimney flue, and of substituting in its place the circular or elliptical tube; or, at all events, of rounding off the corners of the square or oblong flue, if used, as in fig. 56. In cases where the interior of chimney flues are left rough and uneven, as by pieces of lime, stone, or brick left projecting, the friction created tends very considerably to reduce the strength of current. The interior, therefore, should be made smooth. This is generally done in a very inefficient manner by what is called "pargetting"—that is, lining the flue with a composition of lime, plaster, and cow-dung. When flues are made circular, they may be constructed in one of two ways: first, they may be built in the thickness of the wall as the building progresses, a circular mould being used, and drawn up as required; and which may be made of any diameter required. After the withdrawal of the mould, the inside should be carefully smoothed. This slow and expensive method is almost entirely superseded by using earthenware tubes, which are made of all diameters, and parts of them are curved to almost every required radius, so that the flues can be led in any desired direction; and, as they are made in short lengths, as in fig. 57, the flues can be carried up simultaneously with the walls. The earthenware tubes also possess another advantage, which is, that the interior can be made so very smooth—as in the vitrified tubes—that the soot will not adhere to them for a great length of time. Considerable advantage would be obtained by making the diameter of the flue decrease as the height increased. The reason why we recommend this is simply that, as the smoke reaches the higher part of the chimney, its heat decreases. To keep, therefore, the body of heated air closely together, as its temperament decreases, the diameter of

Fig. 56.

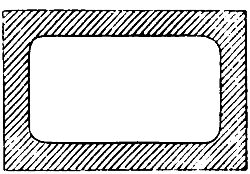


Fig. 57.

the flue should be lessened. As the carrying out of this plan will be inducive of some trouble and expense, it may be better to make the flue the same diameter throughout. In factories, this last suggestion is always enforced, and, taking everything into consideration, there are no chimneys which give greater satisfaction than those of factory establishments; and this, be it marked, under what in ordinary chimney flues are considered great disadvantages—such as causing the smoke to traverse great lengths in horizontal flues before entering the main vertical one. As to the carrying up of chimney flues, it is to be considered as a rule that—other things being equal—the straighter it ascends, and the fewer the curves and bends in it, the better. The natural course of heated air being upwards, it is obviously the most reasonable plan to make the passage for its exit as vertical as possible; and, in this view of the matter, all deviations from the vertical are to be considered as militating against the speedy removal of the products of combustion. In some cases, however, a deviation from this rule is not only allowable, but necessary—as where a house is built in a range with others, or where the flues are numerous in a single house, the direction of some of them must necessarily be changed, to avoid those from other apartments. In all cases, however, where curves are imperatively required, they should be made easy, and of as great a radius as possible—carefully avoiding all right-angled or oblique bends, also roughness or projections in their interior. If satisfaction is really desired, too much attention cannot be paid to the consideration of the direction of flues; and as to the manner in which they are changed, if a change happens to be necessary, where any lengthy deviation from the vertical cannot be avoided, it should be compensated for by lengthening thereafter the vertical part of the flue.

We have now to consider the *position* of the entrance of the chimney with reference to the means of burning fuel below it. As before stated, the hotter the products of combustion in the chimney, the quicker will be their ascent; "for as the smoke is forced up the chimney merely by the rarefaction of the air in consequence of the heat, it is evident that the more the air is heated with the greater force will it ascend, because the difference between the weight of the external and internal air will be greater; and as the air will be more heated the nearer it is made to pass over the fire in its entrance into the vent, it is evident that the sooner the wideness of the fireplace is contracted into the tubular form of the vent, and the lower down or the closer to the fire that contraction takes place, the air in entering it will be made to pass the nearer to the fire, and so, being more heated and rarefied, will ascend and carry the smoke along with it with the greater velocity." To attain this desideratum, then, it is necessary not to have the height from the hearth to the under side of the mantel-tree too great. A propor-

tion which has been strongly recommended is, that the height should be one-third of the whole height of the room from the floor-line to the ceiling. A good method of causing the air entering the chimney to pass near the fire is to make the back of the grate circular, and gradually to lessen its diameter upwards, making the sides in like manner curve inwards till they nearly meet, leaving a circular aperture which would form the throat of the flue. Or the plan given in figs. 60 and 61 may be adopted, of making the chimney bearer and entrance to the flue in one piece of cast-iron. As a general rule, it may be stated that the less cold air is allowed to go up the chimney, the better will be the draught. In stoves and furnaces, all the air is forced to pass through the burning fuel, where it is sure to be greatly heated; and the nearer we can bring our fireplaces to this standard, the more efficient and economical they will be. Of course there are obstructions to this being efficiently carried out, the chief being the general favour in which a cheerful open fireplace is held. Nevertheless we may, by a judicious investigation of principles, bring the open fireplace, with its *exposed orifice of chimney*, to a considerable degree of perfection.

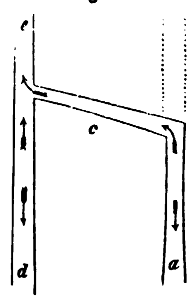
We are now prepared to enter briefly into the consideration of the *size* of the chimney flue. That the dimensions of these have been fixed upon by no particular rules, but have been dependent upon what the practitioner might consider right, or deduced from experience generally extremely fallacious, an examination of any given number of flues would easily demonstrate. One opinion is, that flues cannot be made too large; they are consequently constructed of dimensions sufficient to serve for the chimney of a 30-horse power steam-engine. This is no exaggeration. Rarely, indeed, are they made small enough to serve effectually as good drawing flues. For kitchen fires a good size in middle-class houses would be from 9 to 12 inches in diameter; while for sitting-rooms 7 to 9 would be ample. We are quite aware that such is the effect of prejudice and long-continued system, that these dimensions will be looked upon by many as *absurdly* small; but in this respect we hope that true theory as well as *good* practice will bear us out. We have heard of one who gave it as his opinion that he never could make his kitchen chimney too large, even if he went to the extent of 18 by 18 inches. Now, if this is a proper size, the engineers of our factories must err grievously as to the dimensions of the chimneys they employ. What are the facts? It is notorious that steam-engine and factory chimneys have always good draught; such a thing as a smoky engine chimney—that is, smoky in the sense we take the phrase as applied to apartments—is never heard of; and yet, as before mentioned, in every case nearly, the smoke is led round and round in a horizontal direction before it is admitted to the vertical flue, thus incurring chances of bad draught never met with in common fireplaces. A flue 20

inches square, and 80 feet high, will take away the smoke from the furnace of an engine consuming a quantity of fuel equal to 300 lb. an hour. Now it certainly seems out of all proportion to give the dimensions of 18 inches square to a kitchen flue, the fire of which will not consume a like quantity of fuel in less than twenty-four, probably thirty-six hours. A stove, amply sufficient to heat a large apartment, and consuming a considerable quantity of fuel every day, is supplied with a small tube to act as a chimney, and it performs its functions as such admirably. How is it that it does so? Simply because the fuel is consumed under circumstances highly favourable to its economic combustion. And so in like manner could we have common fireplaces heating rooms very economically, if we would only attend to the true principles which govern economic combustion when applied to ordinary heating purposes. As a guide which may be followed with safety in ascertaining the dimensions of a flue in cases where the height is known, we give Mr Tredgold's rule: it is based upon accurate experiments, and has special reference to the size of grate, height of chimney, and quantity of fuel consumed in a given time. In fixing the proportion, Mr Tredgold observed, that "for each three inches in length of a grate of the usual proportions, we may estimate 1 lb. of coal per hour at an average, but that it affords about double the quantity of smoke at first; and the effective excess of temperature in the chimney is about 16° when this quantity of fuel is necessary: consequently it appears that the area of the section of the chimney must be sufficient for [illegible] cubic feet of smoke to escape in an hour for each inch in length of grate." The following is the rule deduced from this:—Let seventeen times the length of the grate in inches be divided by the square root of the height of the chimney in feet, and the quotient is the area for the aperture in inches. To the size thus found one-fourth may be added, which will bring the dimensions to somewhat like the exact size. A fireplace 12 inches long, with a chimney 25 feet high, having a diameter of 6½ inches, will be found to answer.

In building chimneys, it ought to be an essential requisite in construction that no timber be allowed to be near them. As to the absurdity—often, by the way, practised—of passing beams through them, we hope there is no need to dilate further upon. Circular earthenware tubes, when used as flues, possess this advantage, that no wood can be passed through them; and luckily they are made thick enough to prevent the communication of heat of a dangerous temperature to surrounding materials, even should those be of wood. All chimney flues should be carried up to the same height above the roof: if not so, the tall ones would overpower the short. Every flue should be independent—that is, it should not communicate with another before issuing to the external air. Such communication, too general in its adoption, is a fruitful source of

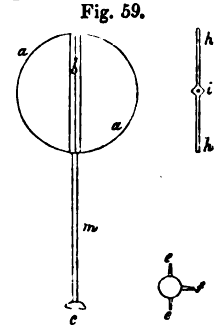
smoky chimneys. Thus in fig. 58, the flue of one fireplace *a*, instead of being continued upwards to the roof, as in the dotted lines above, is deflected at *c*, and joins the flue *d*, the smoke from both flues arising at *e*. This plan involves some contradictions which may be worthy of notice, as evidencing the hap-hazard methods carried out, when unaided by theory and sound reasoning. If the chimney *d* is well adapted in point of size to carry off its own smoke, it is very evident that when the smoke of *a* is added to it, there will be a deficiency of flue-room in *d* at its upper part. When the flue *a* is not in use, the flue *d* will be too large for the smoke from its fireplace. Moreover, the cold air entering from *a* will lessen the ascensional force of that from *d;* and it will be so reduced that smoke may enter the apartment at *d*—at least, it will have less power to resist the force of any current blowing down. Again, it is to be noted that, by making *a* enter *d* at *c*, so much of the effective length of *d* will be subtracted, as the length in this case will only date from the foot of the chimney up to the point of junction of the two at *c*. Again, when there is a fire in *a* and none in *d*, a down current, from many causes, may be established in *d*, and smoke will be conveyed from *a* to the apartment of *d*. A very strong fire in *d*, not properly supplied with air below, would draw its supply down the chimney; and if a weak fire happened to be in *a*, the probability is, that its smoke, entering *d* at *c*, instead of passing out at *e*, would be drawn down to the fire at the foot of *d*.

Fig. 58.



At the foot of every chimney, in every apartment, a valve should be placed just above the throat or opening of the flue: this is exceedingly useful, not only in regulating the draught and the consequent rule of combustion of the fuel in the grate, but when the fire is not in use, by shutting it close down, all "back smoke"—that is, smoke from other chimneys brought down by adverse currents—will be prevented from entering the apartment. These valves may be made in a variety of ways: the common flap of the register grate will do well, if carefully made and adjusted; or the damper-valve, which slides in a frame, may be used. The form shown in fig. 59 may be easily constructed. Let *a a* be the circular aperture of the chimney flue; a projecting ledge goes round this on the upper side; at the two ends of its diameter, coinciding with a line drawn at right angles to the line of the chimney bar, or breast, two small apertures are made; the spindle of the valve *b b* works in these;

Fig. 59.



the spindle *m* is continued outwards, and passed through an aperture in the mantel-piece, and provided with a small button *c*, by which the valve is turned. A half turn of this will open the valve fully. In order to know the amount of opening, the button should have two projecting studs, as at *e e:* when these are vertical, or at right angles with the floor, the valve is shut; when horizontal, as at *f*, it is open. The valve is thus easily adjusted to any degree of opening. The chimney-bar and valve opening may be advantageously made in one of cast-iron, as in figs. 60 and 61, where fig. 60 is an elevation, and fig. 61 a plan. The brickwork of the flue rests on *a a*, which serves as a chimney-bearer, thus obviating all necessity for using the dangerous material wood for this purpose. The hood or stopper *b b* tapers gradually upwards to the size designed for that of the flue. The upper part of *b* forms the throat of the chimney; if the flue is made of circular tubes, they rest on the upper edge of *b*. The valve is shown at *d*, and in fig. 61 it is shown open. A modification of this plan of making the chimney-hopper and bar in one of cast-iron has been recently registered. In this, however, the opening forming the throat of the flue is left square, and of the usual orthodox size of 14 inches by 9 inches—a size of flue which, from its almost universal adoption by builders, seems to be held of vital importance to their efficient working. We should have been glad to see the registree of this otherwise important improvement in chimney construction endeavouring to aid parties in leaving the beaten path, and in introducing that which would be a real benefit in construction, namely, circular apertures, and a variety of sizes, so as to suit different dimensions of flues—not merely issuing one size to suit every case, an empirical practice much resembling that of quack-medicine vendors, who promise to cure every disease by using only one remedy.

Fig. 60.

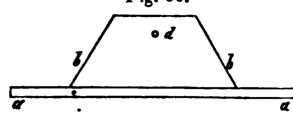
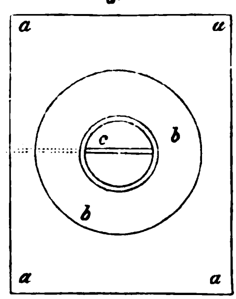


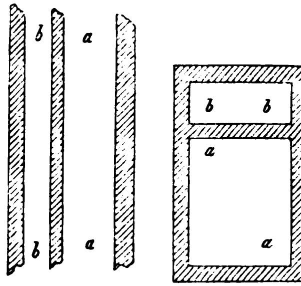
Fig. 61.



While arranging and planning structures, however simple, it should always be borne in mind that the chimney flue possesses certain advantages as a ventilator which ought not to be overlooked. We do not here allude to the practice of making openings through walls communicating with the interior of the flues, and thus causing the vitiated air to be carried off along with the smoke, thus necessitating the use of valves and other contrivances; but would more particularly call attention to the plan, now so much advocated, of making separate flues alongside or in juxtaposition with chimneys, in order to form ventilators. Thus the

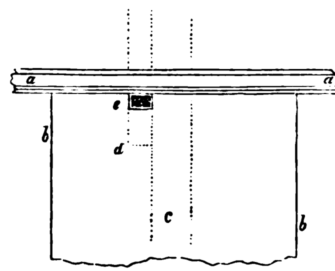
heat of the chimney is communicated to the air in the flue near it; and if the air in the room is admitted to this smaller flue, the upward current created will carry off the vitiated air from the apartment; that is, if the communications required are made in a proper place and way. Thus, in fig. 62, if *a a* is a chimney flue, and *b b* a smaller one alongside of it, divided by a partition of brick or stone, the heat of the smoke in the chimney *a a* will be communicated through the partition to the air in *b b*, and an upward current therein will be produced.

Fig. 62.



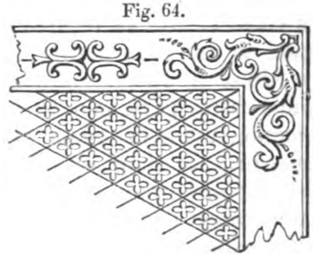
Now, suppose *a a*, fig. 63, to be the cornice at the ceiling of a room, *b b* the chimney-breast, the dotted lines representing the course of the chimney flue and that of the ventilator, the latter beginning somewhere about *d*, a short distance beneath the cornice *a a*. Now, if an aperture is made at *e*, communicating with the interior of the ventilating flue, the upward current therein will withdraw the vitiated air from the room through the aperture *e*, which may be covered with an ornamental grating, as in fig. 64.

Fig. 63.



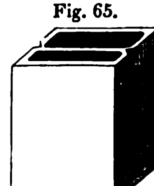
This is a very simple and efficacious method of withdrawing vitiated air from apartments; it is constantly in action, and, from having no movable parts about it, it is never likely to be disused through getting out of repair. There are numerous ways of carrying out this principle. In figs. 65, 66, we give a "registered" form which has been much introduced recently—the large flue is the chimney, the small one the ventilator.

Fig. 64.



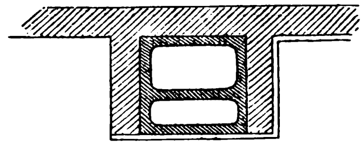
With this construction the ventilating flue can be placed nearest the room, or outside of the chimney-breast, as in fig. 66, thus enabling the aperture for admitting the vitiated air to be made in the centre of the chimney-breast, which would look better than if placed at one side, as at *e*, fig. 63. From the square outline of this frame of double tube, the flues from a good number of apartments may be joined and run up in one central stack. "In a dwelling three stories

Fig. 65.



high, for instance, consisting of six rooms, or two dwellings of three rooms each, the whole of the six chimney-tubes and ventilating flues may be carried up in one tubular stalk; the tubes, as they proceeded upwards, would be firmly tied together, and secured by the floors, and at the top, outside the building, might be held together by an iron hoop concealed by an ornamental moulding. In the two lower stories, the egress openings would not be in the centres of their respective chimney-breasts; but as they would require a valve, or sliding-plate, with a frame of iron or brass, another and similar frame might be fixed at an equal distance on the other side of the centre line. The hollow space that would be left under the elbows should be filled in with brickwork, and the front and sides of the whole mass plastered, which completes the chimney-breast all the way up."

Fig. 66.



By the use of these double tubes much brickwork in the chimney-breasts is saved; and where this is of importance, as in brick buildings, the projection being less, a little extra space is added to the room. Where single chimney flues are run up separately, double tubes of an elliptical form, as in fig. 67, might be used. The chimney flue would thus be completely circular, the shape of the ventilating flue would be slightly irregular, but in nowise calculated to retard the ascent of the vitiated air: *a* is the chimney, *b* the ventilating shaft; they should be made in short lengths, those pieces which were designed to have the aperture of communication made in them being provided with apertures, or short lengths of pipes projecting from their surface, as in fig. 68: a plain earthenware tube might be attached to this, and communicate at once with the room.

Fig. 67.

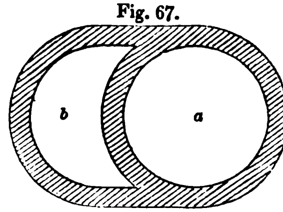
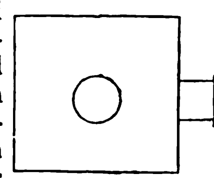
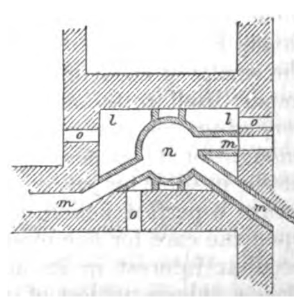


Fig. 68.



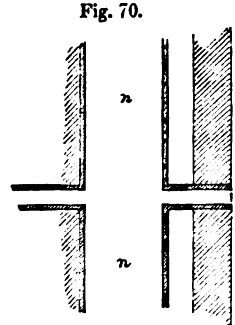
We here notice a method of using earthenware tubes for chimney flues in conjunction with those for ventilating, which possesses some novelty: it has been recently introduced by Mr Wigginton, architect, of Derby. By the aid of fig. 69 we hope to make the mode clearly understood; it is in every way worthy of notice; it is, however, more particularly applicable to ranges

Fig. 69.



of houses or apartments, one central flue serving as a chimney for leading off the smoke from various minor chimneys communicating with it, just as the large chimney in a factory serves to lead off the smoke from a number of furnaces and fires. "The main funnel or smoke-flue *n*, fig 69, is formed of earthenware tubes. The tubes composing this, instead of being bedded or built close up to the brickwork, is placed in the centre of a shaft formed in the brick-work, which is of size sufficient to allow a space of 2½ inches round the inner tube, as at *l l*. The inner tube is kept in its position by a header in the brickwork at every 2 feet in height. A better way would be to have projecting snugs to each of the tubes, about 3 inches broad, 1½ inches thick, and of length sufficient, when built in the shaft *l l*, to allow of the space of 2½ inches round, by which means the inner tube would be well supported. Access from the various fireplaces is had to the interior of the inner smoke-flue by apertures marked *m m*, which may be made of earthenware tubes; the communication between the rooms to be ventilated and the ventilating shaft *l l* is made by means of the ventiducts *o o*. The main flue *n*, as in section *n n*, fig. 70, should be bent at the base, and inclined to the exterior of the building, having a valve at the lower extremity, closed externally by an air-tight lid or door. This would render it easy of cleaning and withdrawing the soot. Branch flues from the fireplaces, of a much smaller diameter, should communicate with the main flue through the walls, which would be found, from the smallness of the throat, as it were, efficacious in carrying off the smoke, and easy of sweeping by a small brush, throwing the soot from the room, obviating thereby the disagreeableness of carrying the soot through the room, and its consequent disarrangement. The top of the main shaft should be secured by a cowl or louvre-constructed head to keep out the weather, and break the force of the wind, as well as to preserve the entire heat of the funnel from flying off. The heat imparted to the main shaft by the smoke of each fireplace would be very great, and would again impart itself to the air-chamber between the brickwork and tube, rendering the air sufficiently light to create a current strong enough for its purpose of ventiduct. By this arrangement it would not be possible for any stoppage to take place, but, on the contrary, insure a perfect action, not dependent upon wind or weather, or upon the care for one moment of the occupants, thus possessing a peculiar interest in its adaptation to the houses of the working classes, where neglect of good appliances are, through ignorance

Fig. 70.



or carelessness, of general occurrence." For these particulars of this method of using earthenware tubes in conjunction with ventilating shafts, we are indebted to an article in the *Artizan* by Mr Wigginton.

Each grate or fireplace should have a supply of air independent of that which may be obtained from casual means, as through the chinks of doors and windows. This independent supply is a matter of the greatest importance: without this being attended to, the chimney, however well constructed, will in all probability smoke; and most certainly this will be the case if the doors and windows happen to fit tightly. Again, by adopting this precaution of giving each fireplace an independent supply, all cross currents and unpleasant draughts are avoided. A cold-air flue, made of earthenware tubes, grated at the outside, to prevent the entrance of extraneous matter, should be provided to every room, running along under the flooring: this flue, shortly before approaching the fireplace, should branch off in two directions—one leading to the heating air-chamber behind the grating, as in Figs. 50, 51, 53, and 54, the other to the front of the grate. The air from this latter branch should find access to the bars through an aperture made in the hearth; or, what would be better, in the side-jambs of the fireplace, a little above the level of the hearth. If the former plan were adopted, some method would be required to prevent the ashes, &c., falling down through the apertures in the hearth to the cold-air flue beneath; they might be covered with the fender, and this provided with a few sloping apertures, to allow the air to gain access from beneath. Another, and we think a better plan, might be adopted thus: To insure good combustion of the fuel in the grate, the air should be made to pass from beneath, entering through the bottom bars to the fuel; to do which effectually, the cold air from the flue should be allowed to gain access through apertures in the hearth immediately beneath the bottom bars: to prevent the ashes falling down the holes, a flat iron receptacle should be placed beneath the bars; this should have a double bottom, the upper or false one being made in a form to catch the falling ashes and cinders, so that they could be easily removed; the lower bottom should be perforated, thus allowing the air from the flue beneath to pass up into the space between the upper and under bottoms; this space should be some half-inch thick, the *sides* being punched full of small apertures: thus the air would find access through these to the fire above; but, from their position, the ashes could not possibly fall through them. In all cases, as, with the utmost care, ashes, &c., will gain access to the cold-air flue through the apertures in the hearth, it will be advisable to allow the air to pass through an iron grating, which should be hinged at one side, or easily removable altogether; and the ashes, &c., gaining access to the flue, would thus be easily removed from time to time as required.

The *height* of the chimney will depend altogether upon local circumstances; in which point it is perhaps only necessary to state very generally, that the higher — other circumstances being favourable — the chimney is, the better will its draught be. There is doubtless a limit to this, but in ordinary cases of house construction, it is very unlikely that this limit will be reached. If a chimney is carefully made as recommended, and the draught is found deficient, the effective length of the flue may be increased by adding a few feet to it externally, and this may be done by running up a few lengths of tube or a pipe of iron properly secured. We should recommend earthenware to be adopted for this purpose, as, the conducting power being slow, the heat of the smoke will be retained for a longer time than if iron or other quick-conducting material was used; and this point, as our readers know, is of some importance. The *form* of the chimney-pot—with which the exit aperture of all chimney flues *should* be finished—is of some importance. Its shape and ornament is generally left to the taste of the owner, or to be dictated by the prevailing style of ornamentation observed in the house; but it is well to note here, that the *mere* "form of the chimney-pot has also an influence on the free passage of the smoke. Many of these fancy chimney-pots, ornamented singly or clustered together, will cause the chimneys to smoke in strong winds, the ornaments serving as points of resistance to the wind, after reflecting it down the chimney." As a general rule, it may be stated that single pots, having free spaces between them, are better than large stalks having broad surfaces — the wind, in blowing over this surface with great velocity in high winds, pressing the smoke down. We should recommend the top edges of all pots, of whatever form, to be made angularly, sloping upwards from the outer edge, which will deflect the passing wind upwards, and assist the upward current of the smoke.

As to the subject of the cure of smoky chimneys, we beg to refer the reader to pages 48 to 51 of this Journal for July 1849, where he will find some remarks on this—to many a sufferer by the nuisance—very interesting subject; and also to our work on "Practical Ventilation," where the matter is more fully treated of—our remarks in the present papers being more particularly applicable to contemplated structures, and the details of their arrangement and construction, rather than to the noticing of plans for the improvement or amendment of those which are already built. We may, however, state, that if the plans we have recommended for the construction of fireplaces and chimneys be carried out in their entirety, there is little chance of the apartments being visited with the smoke from the burning fuel—taking care, however, that the following exceptional cases are

duly provided against:—If a low cottage is built against an existing building of superior altitude, then, in certain winds, the smoke will be forced down the cottage chimney by the wind beating against the high house, and being deflected downwards. The only sure remedy in this case is to carry the chimney of the cottage to the same height as the chimneys of the house, or the blow-down may in some measure be prevented by adding a "wind guard"—hereafter noticed—to the top of the cottage chimney. In like manner, where a servant's or other bedroom is constructed behind a dwelling-house, and of low altitude as compared to that of the house, in certain winds the chimney of the bedroom will smoke. The cure in this case is the same as above noticed. Again, a house built at the foot of an overhanging or steep hill will in certain winds have smoky chimneys. A form of wind guard, which will be found useful in such cases, is shown by *a* and *d*, in fig. 71. The part at *c c*, in fig. 71, shows the angular form which assists in the upward deflection of the passing wind, and which, in a former and recent paragraph, we have recommended as the shape of the upper edge of all chimney-pots. Fig. 72 is a ventilator in which the upward current in the chimney flue maintains a continual flow of air from the apartment through the holes *c*. If a blow-down is caused, the smoke passing along the tube *b* is thrown against the solid part of the plate *d*. Unless the blow-down is of very long continuance, the smoke is driven back into the chimney by the current through the apertures *c*. This ventilator is placed in a hole of the wall, *f f*, and *g h* forms the cover to it. While on this point, we may notice, in conclusion, that "whatever in any measure disturbs the free motion of the air is in danger of producing sudden gusts, which may occasion smoke. Therefore, whoever builds in a situation that is not altogether free, may lay his account for having some sudden gusts of smoke, unless the chimney-tops be so formed as to obviate such a result. There are some situations so much exposed to sudden gusts of wind, which is sometimes whirled round, sometimes beaten suddenly downwards, or as suddenly carried up again, that it is difficult to guard against every danger. In such situations, chimney-tops close above; but having side-spouts pointing both *upwards* and downwards at the openings,

Fig. 71.

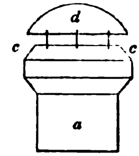
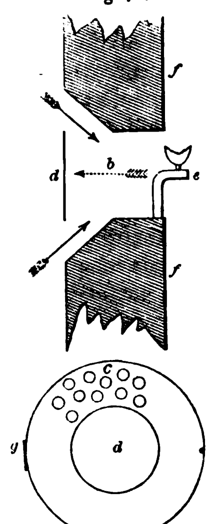


Fig 72.



though coming out from the chimney-top at right angles, would be proof against any wind whatever."

In concluding our remarks in this department of our papers, we may be expected to say something as to the different forms and kinds of grates, which are offered to intending purchasers in an endless variety. On this point we beg to quote some remarks we have given elsewhere on this subject: "To give a list of the names of the various grates which have been introduced from time to time, and to point out their peculiarities, would occupy more space than their intrinsic merits deserve. Numerous as have been their forms, the principle has been very nearly the same in all of them; the alterations, or alleged improvements, consisting more in the manner in which the fuel was consumed or applied, than in the alteration or improvement of the heating surfaces. There have been, nevertheless, a few arrangements by which the radiation of the heat into the room has been materially assisted by the admirable arrangement of the parts; and those of Sylvester and Joyce deserve especial notice; for as radiant heat is assuredly the most healthy and agreeable, any plan by which the radiation from a common fireplace can be increased must be a boon of some value to the community. To these may be added Cundy's patent fireplace, as a grate which is very effective in this respect, from the excellent arrangement of the heating surfaces; Mr Cundy having wisely discarded all cast-iron and iron as generally used, save for the external ornamentation, he allows, in place of which, the flame and heated air to pass over, and in contact with, masses of Stourbridge clay, a material which rarely attains a heat sufficient to burn the fresh air suffered to come in contact with it. The fresh air to be heated passes along a flue or flues connected with the external air, into the hot-air chambers formed by the clay, and afterwards into the apartment. By an excellent arrangement of the clay surfaces, their full heating effect can be obtained in the manner of a well-arranged stove, yet the cheerfulness of the open fireplace is still retained. The fresh air gaining admittance from the exterior to the place beneath the fire-bars, the fuel is so well supplied with the air necessary for combustion, that, with a well-constructed chimney, no fear of smoke entering the room need be apprehended. Upon the whole, this stove, or fireplace, appears to rank as the most efficient, and certainly the most economical, yet introduced." One sentence more upon this part of our subject: all grates should be permanent fixtures; a grate well fixed up, with reference to a certain size of fireplace, should remain: we cannot sufficiently condemn the practice of pulling them down on every change of tenant; they should be the landlord's property, as is the case throughout England; the practice of removing them, obtained generally in Scotland, is inducive of expense and danger, which it is quite at variance with a good system needlessly to incur.

THE FARMERS' NOTE-BOOK.—NO. XXXV.

Characteristics of the year 1851. By Mr TOWERS.—Independently of the general objects of these yearly articles, I now avow that it appears desirable to devote particular attention to the meteoric phenomena which precede, accompany, and immediately follow the periods of the two equinoxes; that is, about the 20th or 21st of March, and the 22d, 23d, or 24th of September, in every year, when the two great circles (the ecliptic and equinoctial) intersect each other. It is possible that, by strict attention, we may be able to ascertain whether something like a trustworthy indication of the weather which is likely to prevail during the major part of the intervening months may thus be obtained. Experience during an extended course of years has tended to justify a theory which assumes, as a type of the future, the weather that predominates during the week of which the equinoctial day forms the centre. But there are many observant persons who doubt, and others who entirely repudiate, the theory. Hence, and in order to obviate anything which may assume the appearance of superstition, I would invite a most rigid investigation by those who register meteorological data.

January came in with a medium pressure of the atmosphere, (29 in. 72 cts.,) declining several cents on the average, till the ninth evening. The mercury then rose above 30 inches, and may be rated at about that height to the 20th, after which date much fluctuation was observed, the month terminating with the mark at 29.20 in. The temperature of the entire month was mild in East Surrey. The lowest average of the five first nights my table rates at 45°.6 in.; the highest of the days, 48°.6 in. The coolest, and indeed the only period when any frost was noted, includes the 23d–25th mornings, when 32°, 30°, and 30½° were read off. I therefore shall no farther particularise, but only state the average of all the nights at 39°.38; that of the day maximum at 46°.84. The wind blew from a south or south-westerly quarter on twenty-five of the days; easterly, or by south, on five days; and scarcely for one entire day from the west, or a point to the north. Rain fell, according to my table, on fifteen days, rarely in any quantity; on the 31st, with a hint of snow. The sun shone out on eleven days at intervals, the atmosphere being overcast with clouds.

February.—The barometer was depressed to 29.4 in. on the first morning, but was rising, and continued to rise, till the mercury marked 30 in. plus on the 6th. After this first period, it continued high, averaging about 30.15 in. till the 19th. It then fluctuated something below 30 in., terminating at 30 in., after a sudden and considerable rise to 30.38 in., on the 27th. The temperature

throughout was lower than it had been in the preceding month, though it still remained mild, and little resembling that of winter. Dividing the shortest month into two periods of fourteen days, the minimum by night may be called 35°; the maximum by day 44° plus a fraction. The mercury fell to or below the freezing-point about sunrise on the 3d; to 30½° (the lowest) on the 4th, 9th, and 11th: the average of the second half, 34°, and 46.2 in.; but herein there were essential variations, namely, six of the mornings were below the freezing-point, with more or less rime on the herbage. On the 17th there were 7°, (25° F.,) the ground being crisp throughout the day. The wind was N.E. on the 1st, 21st, and 26th. N., or by W., on seven days; S., or by W., on the 3d, 4th, 7th, 11th, 17th, 18th, 19th, 20th. On the remaining days, W., or south-easterly; in force it was gentle, if we except the 5th, 19th, 26th, 27th, when we consider it brisk, and on a few occasions a little fresh or lively. February failed in its usual characteristics; there were no sunshine, rains, or melting snows. I find only 10 intervening days when any rain fell; the other 18 were either sunny or dry, though 11 of them may be described as overcast; mere hints of snow are marked against the dates 24th, 27th, 28th. Agriculturally, the month was neutral; the ground was neither mellowed by frost nor swamped with rain. The clovers, sainfoin, and sown grasses, were perfectly green; and, strange to say, the wheat far from winter proud, and little infested by insects or slugs; but, about our quarter, there was a paucity of winter oats, barley, beans, and kohl-rabi. Turnips and mangel-wurzel remained sound, good, and abundant.

March—our criterion period, to which I solicit attention. The month commenced with that high state of the barometer which was suddenly attained on the 26th ult., by sunrise. On the 2d instant, my table states the highest point to be 30.36 in., at 10 P.M., from which it gradually declined to 30.11 in., and then to 29.99 in. On the fourth evening the wind veered from N.W. to N.E., W. by S., and S. The weather was dry, but either cloudy or hazy, and almost sunless. There were 3° of frost on the 1st, 2° on the 2d; the highest temperature of the days, 41° to 48°. After the 4th to the 19th inclusive, the barometer fluctuated, but progressively fell from 29.99 in. to 29.40 in., and the average temperature was low. The atmosphere was far from clear; rain commenced on the 5th, and recurred at intervals, increasing in quantity; the 17th, 18th, and 19th were wet, the wind veering from E.S.E., and rose almost to a gale from S.W. At this period we notice the first of Kirwan's prognostics; namely, "*a gale from S.W. a few days before the equinox.*" The 20th (its eve) proved fine and sunny, with a fresh southern breeze. At 56 minutes after 4 o'clock in the morning of the 21st, *the sun entered* the equinoctial spring-sign *Aries*, (the Ram;) the weather was fine, but the wind

at W.S.W., brisk in force: the barometer fell to 29.27 in.; there was some small rain at noon. On the 22d and 23d, the mercury marked 28.77 in. to 28.39 in.; the rain fell for many hours on the 22d; and thence to the 31st, so great was the volume of water, that it was estimated by some (according to different local observations) to amount, at the least, to ten or even to twelve and fifteen times that of March 1850! Here I would venture to refer to the *Characteristics* of that year, in proof of the entirely opposite phenomena of the two months, offering, however, the remark that, although the weather of March 1850 was clear dry, with a predominance of keen arid winds, the precise equinoctial transit was attended with changeable indications; and the summer, about the middle of July, responded thereto, severe scourging thunder-storms, followed by much rain, and a low temperature having greatly injured the corn, and retarded its harvesting.

The prevailing winds this month were westerly, by S., sometimes by N. On the 2d day it was N. E., and subsequently S. by E. on five remote occasions. There were five bright and sunny days,—the last occurring on the 31st,—with the barometer rising to 30.15 cts.

The lowest average of all the nights, at 37°.4. The days averaged 48°.

April appears to divide itself into two equal parts, *the first* terminating on the 15th evening. In it there were ten days without rain, though only four were sunny,—the 1st, 5th, 12th, and 13th; the other six generally overcast. Five days were more or less wet. Profuse rain fell on the 5th, and much on the 9th. A lunar pale halo *(parselene)* was observed on the 13th evening. Frosts of a few degrees,—particularly that of the 7th, at 28° of Fahrenheit, with rime and ice, followed by bright sun,—proved fatal to wall-fruits, and, in some places, to the blossom of the gooseberries. The wind was generally easterly, by N. or S. The average of the barometer was above 30 in. till the 8th, then a few cents below 30. The thermometric average of all the nights, 36°.6; those of the days, 49°.

Second part.—From the 15th to the end of April proved the showery period of the month. The wind began to waver toward a western point, whence it came, with about few exceptions, till the first of May. Ten of the days were more or less rainy; five, (18th, 19th, 23d, 24th, and 28th,) dry and tolerably bright, but gloom generally prevailed.

The average height of the barometer was, as nearly as possible, 20.71 in. The wind was gentle, soft, and balmy till the 25th, when it fluctuated, first to N.E., then by N. and W. by N., where it remained to the end; the temperature by night being reduced 10 or more degrees. There was thunder, with hail and rain, on the 29th, and a very sharp hail-shower on the 30th. The tempera-

ture registers the statement of two average calculations,—namely, from the 16th to the 24th, both inclusive, and from the 25th to the night of the 30th. Of the former, I quote the minimum by night, 44°.50,—day, maximum, 60°.4; of the latter, minimum, 34°.6—maximum, near 53°.

May.—The position of the mercury indicates the division of this spring month. The first period—that of low, comparative pressure—extends to the afternoon of the 12th day, the average being 29 in. 8 cts. The wind was variable, W. by N. and by S., easterly, by S. or N. at intervals; generally fresh; very lively or strong on the 8th, 9th, or 10th. Weather changeable; fine, with sun, on the 1st, 2d, 4th, 7th, 8th, and 11th; occasional showers in the intervals. There was thunder, with hail, on the 3d day. Temperature below 40° on the seven first nights; average lowest of the twelve nights, 40°; maximum of those days, 56°. The warmest days were the 10th and 11th, each noted at 67°. *Many oaks* were now in advance of the *ash* trees! Seed-time of spring-corn not propitious, wheat plant good. Fine period commenced with the afternoon of May 12th, for then the barometer rose from 29.85 in. to 30.10 in., and continued (with two very trifling variations of a few cts.) far above 30 in. to the end of the month, when my instrument marked 30.47 in. The winds blew from some eastern point, mostly by N., on the 12th, 13th, 14th, 15th, 24th, 28th, and 31st; from W. or S.W. on the 18th and 19th, 25th and 26th, when we had a few showers,—the only rain of this lovely, brilliant period. The N.W. breezes were gentle and balmy; but the land about Surrey thirsted for that moisture which the spring seedings of oats and barley required.

The thermometric averages of the nineteen days were 45°37′, and would have rated much higher, had not the nights of the 14th, 15th, and 16th been cold; 33° only on the 15th, with frosty rime; the day maximum, 64°.

June divides itself into two pretty equal and distinct periods, the *first* being comparatively moist, excepting the three first days, which were sunny. The barometer began to decline from 30.40 in. on the 1st, and to 29.75 in. on the 3d evening; then the mercury remained at some hundredths of an inch below 30 till the 14th. Rain fell on nine several occasions, so that there were only three dry days between the 3d and the 16th. The winds came from a point between S. and W., except on the 1st, 2d, and 10th days, and were strong and lively between the 4th and 10th.

The average temperature of the fifteen nights are read off at 48°.8′; that of the days, 64°.2′. Some early barley was seen in ear near Croydon on the 13th.

Second, or dry half of the month.—Rapid elevation of the mercury from 29.91 in. on the 16th, to 30.40 in. on the 18th, whence it ranged far above 30 in. to the end, except a slight deviation, with

the wind at E. and S.E., on the 21st day, recovering on the 22d morning, till it stood at 30.2 in. by sundown.

The prevailing wind was westerly, by S.—by N. on 17th, 22d, and 23d days. On the 21st, as stated above, and on the four last days of the month, the current was from the E. and S.E. The atmosphere was clear, and the weather so fine that I can record only one shower, on the 18th, on which day haymaking appeared to commence. This harvest was completed in East Surrey without let or obstacle; its bulk not very considerable, but excellent in quality. Some oats were seen in ear on the 19th, and fine wheat was in blossom.

The temperature became high after noon, in consequence of the great power of the sun. I quote the averages at 53° minimum, 71°.5 maximum. On the 27th, I noted 82° as the highest in the shade, about 2 o'clock P.M., and 124° in the sun on the 28th, at 4 o'clock.

July gave indications of its ordinary changeable character at its commencement. The barometer descended rapidly, falling from 30.10 in. to 29.95 in. The two first days were very warm; the 1st close, with thundery clouds, in wavy grouping, and producing some slight rain; more fell on the 2d. This rain was most beneficial, as the ground had become very droughty; the temperature by night, 60°; at 2 P.M., 76°. On the 3d, the mercury rose to 30 in., and remained at that altitude till the 7th. The wind varied from N.W. N.E. to W., the weather being on the whole fine; but the temperature became so much reduced as greatly to retard the ripening of all the cereal crops. The average of the seven first nights was about 53°.7—that of the day maximum, 72°.4.

On the 8th of July the clouds became heavy, with rain—barometer falling. On the 10th, after night, rain, a fine forenoon, then thunder, hail, and a heavy shower. Three fine days followed. The wind was fresh on the 13th, from W. by S., much cirrus forming at sunset. The breeze became stronger, and brought a little rain, early on the 14th. Just at this period an opportunity was afforded of passing through a considerable portion of South Surrey and Sussex, in company with an agricultural friend; and then were perceived the effects of the ungenial weather of March and April upon the heavy, undrained lands of those districts. Vast breadths of oats and barley were very low and backward. Some fields of wheat—"few and far between"—were promising; but everything gave evidence of a late ingathering. With exception of the 15th, (St Swithin of the new style,) the weather was unpropitiously changeable, and the nights very cool, till the 21st, when a rise in the glass and temperature occurred, and proved beneficial, for harvest operations commenced in the Isle of Thanet, (that granary of London,) and, on a few of the best-farmed lands of Surrey and Berkshire, the wheat began

to change colour. The weather had, however, been so disturbed by thunder-storms, that my table registers only three fine sunny days between the 22d and 31st. The averages of the thermometric registers from the 8th to the 31st days, inclusive, were 51° and a fraction; lowest, barely 69° maximum.

Here I recur to the indications of the spring equinox. They were unequivocally wet—more decidedly so than any that I recollect since 1828. A rainy harvest was therefore anticipated. However, the volume of rain (before referred to) which fell in the last weeks of March, during a considerable portion of April and July, while it justified the prognostic, was mercifully so regulated as to permit not only a propitious hay-harvest, but one of the most bountiful ingatherings of corn that the heart could desire.

August, therefore, claims a rather minute analysis. Its meteorology divides itself into four irregular periods. The *first* extends to noon of the 13th day. The barometer on the 1st, which was cloudy throughout, stood at 29.86 in.; the mercury then ascended gradually to 30.28 in. on the 5th, when it began to recede to 30 in. on the 13th—the average of the period being 30.07 in. The wind was westerly till the 5th, then E. by N. till the 10th, and south-easterly till the 13th, when it wavered, the atmosphere being close and thundery. The last was a day to be remembered; perhaps the most *oppressively* hot (though not the hottest thermometrically) of the summer. Masses of rocky clouds, gorgeously illuminated by the sun, adorned the whole horizon, from W. to N.E. A respected friend witnessed the scene with me, and he will not fail to recollect that wonderful evening, if this notice of it meet his eye. Lightning corruscated and lighted up the clouds in the N.E. But one among the several striking phenomena ought to be particularly recorded. Soon after sunset, three or four suffused rays, of a faint, rosy tint, *pulsated* upwards from the eastern horizon, nearly to the zenith; they somewhat resembled the broader beams of an aurora-borealis, but were most clearly discerned when the eye was slightly turned aside from them. We had no thunder; but these electric phenomena indicated those violent disturbances which broke up the weather of the north-western counties, and considerably retarded the harvest there.

The average lowest temperature of the thirteen nights I quote as 57½°. The maximum of the days, 73° and a fraction.

Second period.—Warm weather was extended to the 22d day inclusive, the winds fluctuating between S.W., N.W., and S.E. The mercurial column stood a few cents below 30 in. to the 17th evening; then it mounted rapidly to its maximum, 30.34, on the 19th; receding to 30.8, where I read it off on the 22d morning. Temperature of the period—lowest average, 54°; highest by day, 72°.

Third period extends to the 29th evening; the temperature

much reduced, and the weather inclined to be changeable and showery. The quantity of rain in Surrey, and, I believe, in the adjoining counties, was comparatively trifling. There were small showers on the 23d, 24th, 27th, and more rain, with strong wind, on the 28th and 29th. The prevailing winds came from the S.W. or intervening points. The barometer averaged 29.9 in.

Fourth period includes the two last days, when a decided change took place, excepting in the temperature, which remained low. The mercury rose from 29.90 to 30.20, the wind north-westerly, and fine weather was established.

Harvest operations were not general till about the 15th; but I saw wheat carried on the 6th. On the 22d, my diary says, "Wheat gone."

September admits of two marked periods: the *first* includes twenty-four entire days, during which the mercury of the barometer retained its high position, that is, above 30 in. on the average. On the first day, it was marked 30.24 in., declining to 30.12 on the second evening—the wind being to the N. of W. On the 3d, the current came from the E. of N., where, with a trifling variation to E. by S. for a few days only, it remained till the 21st. The mercury rose to 30.46 on the 10th; to 30.56 on the 15th, and thence declined slowly to 30 in. on the 24th. The weather was magnificent, and the harvest was completed under most favourable circumstances. In the *second* period, the wind began to waver on the 21st, being then N.; it went back to W. by N. on the 22d, and to S. on the 23d. This was the equinoctial day, when the sun entered the sign Libra at 51 minutes after 3 in the afternoon. I offer no hint of a prognostic from this equinox, which appeared to exert an immediate power of mutation, as rain followed in the night, a southerly current was established, and the atmosphere became cloudy and producing frequent showers. At sunset of the 29th, the western horizon displayed a mass of gloriously illuminated cumuli; and about 10 to 12 at night, a pale suffused light of aurora-borealis was observed in the N. Rain followed in the morning of the 30th.

October came in with the greatest depression of the barometer that I had noted since the 22d of March, (then 28.30 in.!) It stands in my diary 29.5 at 10 o'clock P.M. The wind strong from S.W., the temperature mild, (51° to 60°,) the weather showery; and it continued so to be till the 7th, when, the wind inclining to north-westerly, and the mercury rising to 29.83 in., dry weather returned, and brought the land into a very fitting condition for autumnal operations. It will not be needful to enter minutely upon the particulars of a season peculiarly sober, and of very equable character. The barometer averaged about, or a trifle above, 30 in. till the 28th, when it suddenly and rapidly declined to 29.60 in., where it was read off on the evening of the 31st.

The sun was generally absent; it shone out on 11 days between the 3d and 29th, about mid-day; yet twenty of the days were without rain. The wind generally came from S.W. till the 20th day, gentle in force. It became *calm* from E. and N.E., from the 21st to 26th inclusively; the mercury very high—30.38 in. on 24th; yet the sky was overcast. The few last days were more lively, and cooler; wind northerly, with weather disturbed. One morning alone, (17th,) exhibited a frosty rime; the thermometer marking 36° at about 3 feet above the surface. The averages of temperature stand thus: to the 16th inclusive—lowest, 49°.75, day maximum, 59°.8; from the 16th to the 31st—lowest, 46°.6, day maximum, 56°. There were several gloriously illuminated sunsets, but the clear portions of the western sky were *green*, a phenomenon usually followed by copious rain within a few hours.

In order to caution readers against the fallacy of aspectal prognostics, I state that, in the *Sunday Times*, and, I believe, in other papers, an article appeared, signed by the name of *Wayter*, wherein the conjunction of the sun and moon on the 24th, (the day of the *new moon*,) and the opposition (?) of Saturn and Uranus, with the positions of Venus and Jupiter (almost identical) on the 20th, were made to predict an extensive tempest of no ordinary violence! It only remains to say, that the day throughout proved so *entirely calm* that scarcely a leaf could be said to move. The positions of the planets were certainly interesting: Saturn and Uranus were both in Aries, hence, could not be six signs remote from the sun, then passing from Libra to Scorpio.

November will be long considered a memorable month in Surrey, at all events; for our tables note but six days or nights wherein there was any falling weather. The only rains worthy of note fell in the night, or early morning, between the 6th and 7th, and the 23d and 24th; a mere hint of snow was seen in the forenoon of Sunday, 16th. There were three days with frosty rime in the first week, the thermometer marking 31° of Fahrenheit on the 3d and 4th, and 27½° on the 5th, when ice formed; the heliotropes and dahlias being cut down, and the chrysanthenums, which promised to be profusely bloomed, suffered materially. Westerly winds, veering by N. or S., and of little force, prevailed till the 14th. The direction then changed to N.E., the temperature at 10 P.M. falling to the frosty degree, 32° Fahrenheit. The mercury of the first ten days averaged somewhere about 29.8 in.; it then rose to 30 in., 30.16 in., and by degrees to 30.40 in. on the 13th; falling again to and below 30 in. on the 15th. At that date frost set in, and continued till the end of the month. The averages of temperature, from the 1st to 14th inclusive, were—minimum by night, 36° and a fraction; day maximum about 45°.8. Since night frost commenced on the 15th, the barometer fluctuated periodically between about 29.80 in. from the 15th to 20th; then to 30 in. and

30.16 in. for three days; and so on alternately to the end. The lowest depression was 29.40 in. at 10 P.M. of the 25th; the highest rise, at the same hour of the 30th, 30.21 in. The wind—if a state of lifeless calm could admit of the term—was fluctuating and delusive; the upper and lower currents were peculiarly opposed; below, W. or by N.; above, easterly by N. We have read of gales and storms; but, with a very trifling exception, the current has been little discernible. At the middle of November the verdure of the leaves was remarkable, and in this condition they became paralysed by the strong frosts of the 16th, 17th, and 19th, the lowest mark being 24° of Fahrenheit; though several reports give a greater depression. Sun was powerful by day; sufficiently so to thaw the land, and to raise the atmospheric temperature far above the freezing-point. My averages for the sixteen last days are—lowest, 29¾°; maximum by day, 41°. The lower currents have frequently come from W. or W. by S., till, after noon, the light cirrus, or other dry clouds between—drawn, as it were, insensibly from E. by N.; that current prevailing before close of evening.

Corn-sowing was retarded; little of wheat seen; much remained to be sown. The land, and all crops upon it, were considered excellent.

December came in as November had closed—with a high barometer, (30.21 in.;) the wind either very gentle or almost calm, the sky nearly obscured, almost sunless. The frost ceased with the fourth morning, at 31° Fahr.; wind at W. Thus my table registers nineteen frosty nights since the 14th ult., with the 22d and 24th excepted. The days were nearly frostless, and frequently heated by sun at or about noontide. A table made at the Observatory, Highfield-house, presents us with far greater degrees of cold; as, for instance, Nov. 19, by day, 19°.2; night, 17°—*i. e.* 15° of frost; 29th, by day and night, 21°, or 11° of frost; and always proportionally lower than with me at Croydon, Fairfield, a spot open to due E. nearly.

The next period, 5th to 16th inclusive, was mild, averaging, the days within a fraction, 47°; the nights, (one only—the 12th—at 28°,) 39°.7. The weather dull, calm, and mostly without sun. Scarcely the ⅛th of an inch of rain fell; but there was much haze, or dense fog, which kept the surface of the ground damp, and the roads very dirty. The direction of the air might be about W. by S., varying to south-easterly about the 12th to 17th. A more quiet state of the atmosphere has rarely been recorded.

The barometer was exceedingly high till the 20th. On the 12th, 30°.52, falling slowly to 30°.02. A few showers fell between the 20th and 22d night. The absence of rain in every part of the country has been productive of serious results. Wells fail, as the springs appear to be unwontedly low; cattle suffer, or are driven

far to water; and moisture is supplied to vegetation, not by rain or snow, but by the electric phenomena of fog-haze and low suffused clouds. The altitude of the barometer has been remarkable. On three days of the month, (8th, 21st, and 22d,) the mercury was below 30 inches; this was followed by small rain, as drizzle; and on the 22d and 23d a few showers fell. The mercury rose again to 30.10 in. in the night of the 23d; then to 30.51 in. on the 27th; and declined gradually to 30.10 in. on the 31st at 10 P.M. The weather of the month has been characteristically gloomy; the winds ever fluctuating between all points, but rarely with any discernible force.

Thus has terminated this extraordinary year, 1851; the last day cloudy and dark, the night *still*, with scarcely a breath of air. Absence of sun and wind, and the prevalence of haze, have kept the ground moist. Wheat is subdued in its growth; in many places the plant is hardly discernible: the soil has never been in a kinder condition; the meadows remain verdant; root-crops are fine and abundant; and live stock is reported healthy. What the future may prove we must leave; but for the past we have exceeding cause for gratitude.

New Zealand.—In the *Emigrant's Manual*, published in 1851 by Messrs W. and R. Chambers, Edinburgh, there are the following observations concerning the *agricultural capacities* of those islands —a few remarks upon which may, perhaps, merit particular attention at this time, being suggested by facts that have been established by extensive chemical research:—

There are two kinds of agricultural lands—the forest and the *fern*; and it seems to be undecided which is the better of the two, either for the poor settler demanding rapid returns, or for the capitalist who looks for the best ultimate investment.

Our notice will be devoted to the latter—fresh Fern-land:—

This has one marked peculiarity called "sourness," by which is meant some property hostile to the growth of crops put in directly after the breaking-up. The probable cause of this is the absence in the new soil of such promoters of vegetation as the ammoniacal gases readily absorbed from the atmosphere, when the soil is loosened and exposed; although, if "sourness" arose entirely from this cause, it would appear strange that the bush-land also is not subject to it. If a piece of the finest fern-land be cleared and sown at once with wheat, the yield would probably not exceed fifteen bushels per acre: the same piece prepared nine months beforehand might yield from thirty-five to fifty bushels; but on timber-land this would make no difference. In cultivating fern-land, the first operation is to clear away the fern, which is best done in some dry month. Choosing a gentle breeze, the *fern is fired*: if it burns well, all the thick and matted dead stuff at the bottom, with the leafy part of the live fern, will be consumed, leaving only the shrivelled "*tutu*," and the cane-like fern stalks, which, as softened by the fire, should be cut at once, either with a strong hook, or, still better, with a short scythe, and the "tutu" slashed down with a billhook. Lying a few days to wither, the stalks are loosely raked up, and burned with the "tutu" branches; and the "tutu" stumps have then to be taken up and carted into a heap or carried off."

Operations consisting of ploughing to the depth of about ten inches, the soil, being thus broken up, is left to become pulverised,

and to dry the fern-roots. It is then raked or harrowed, the roots burned; and thus, by such operations, repeated as required to bring the land into fine order, it is left for about *six months* before it is cropped.

Now, instead of allowing this delay, I offer the following considerations, based upon certain ascertained data. It is proved that *quicklime*, or its dry hydrate, is the absolute specific meliorator of soil, degraded, and as it were poisoned, by redundant vegetable inert matter: thus it reclaims peat-mosses, and restores the fertility of soils overcharged with humus, or its element, called humic acid. If then the fresh moved fern-land be glutted with decaying vegetable remains, the application of a large dose of lime would attract and *fix* the humous matter, and produce an *insoluble* humate of lime. All the true alkalies—namely, potash, soda, and ammonia, the last particularly—unite with the vegetable extractive, and produce dark-coloured infusions similar to the black liquid manure which drains to waste from old dunghills; but lime, if added to any or all of those brown liquids, will attract the humic acid from them, fix it, and fall down as a flocculant precipitate of humate of lime! Any person may convince himself of the fact, by mixing a very little powdered lime, or even strong lime-water, with the brown fluid manure; for after a little time the flocks will fall, and the colouring matter be discharged.

If the fern alluded to resemble the plants known as such in Britain, its ash will contain carbonate of potash, and with *that* the matter which produces sourness will combine as a *soluble* salt; the same may be said of the ammonia introduced by rain-water. In every case, however, lime would prove a specific antidote, its attractive power being predominant, and its operation so direct and rapid that, supposing the theory of the writer to be correct on the point of sourness, the land would be immediately brought into a healthy condition for any crop, subject only to those manual operations which produce pulverisation, and an even, well-wrought surface.

Forest Trees on Peat-Moss. By Mr PETER MACKENZIE, West Plean, Stirling.—A notice of the size and condition of some of the trees planted on peat-moss, belonging to A. B. Monro, Esq. of Auchinbowie, in Stirlingshire, may be interesting to many readers of the Journal; and those who have peat-moss may thereby be induced to plant it with trees that may become useful, and thus obtain from it a better crop than bent and heather. The peat at Auchinbowie is about six feet deep, and was planted about ninety years ago. Some fine specimens of larch, Scotch fir, and hardwood trees have been cut down since that time, and a few still remain as monuments of a past age, to encourage those of the present, who have the opportunity, to put in a tree when they can,

even in a peat-moss; and if a square foot of timber can be obtained for every square foot of surface planted, during the long period, it may be, of a century, the labour of planting will not have been in vain.

The larch is a tree that will not thrive in every soil—and much has been written and said, of late years, about its decay; but, like the potato disease, it seems to puzzle the best vegetable physiologists to ascertain its cause. As many useful things may be learned from observation as well as from experiment, those who have turned their attention to the subject are able to say, that larch is mostly at all times in good health that grows upon peat-moss that has been well drained. Some specimens of the old larch contain eighty feet of timber of excellent quality. It is usually recommended by most planters, when one kind of tree has grown to maturity and cut down, that another kind should succeed it; but it appears that larch may be planted a second time, and thrive well on peat-moss: since many of the first planted have been cut down, others have been planted which are in a healthy state, and measure thirty feet of timber, and at sixteen or eighteen feet apart are too close; while still younger trees are making great progress close to the old and tall ones, so that the roots of all must intermingle;—and thus, taking the old and the young trees together, the peat-moss must have a heavy burden of timber to support.

Beautiful trees of Scotch fir are found on the moss along with the larch, they being seemingly the true *Pinus sylvestris horizontalis*, bearing upwards of eighty feet of timber. At a sale which took place some years ago, some of their comrades brought a price nearly equal to that of foreign timber.

A few years since, in an article of this Journal, "On the Expediency of forming Arboricultural Societies," we stated that, "in Scotch-fir plantations several varieties may be observed growing together. There is a very inferior one common enough in most woods; it has short leaves, and those thinly set upon the branches, and, as a necessary consequence, it produces but little timber. There is another variety—and perhaps it is the most common in our country at the present day—which, when planted in proper situations, grows rapidly; but the quality of the timber is inferior compared with another variety which is cultivated in some parks in the neighbourhood of Stirling. The oldest trees of this variety of Scotch fir with which I am acquainted are growing on the Auchinbowie estate, four miles from Stirling. There are also trees of the same kind growing at Blair-Drummond, which are said to have been raised from seed gathered from those of Auchinbowie. Their worth is appreciated at Blair-Drummond; and the seed they produce is carefully preserved, in order to raise young plantations of valuable timber." I ought to have mentioned at that time, that many of these valuable fir-trees grew, and are still

growing, upon peat-moss. When we bear in mind that there are still many thousands of acres of peat that may be profitably planted, the thanks of the country are due to those proprietors who have set the example of treating peat-moss in this manner; and they may exclaim with Beattie's Hermit—

What cannot art and industry perform,
When science plans the progress of their toil!
They smile at penury, disease, and storm;
And oceans from their mighty mounds recoil.
When tyrants scourge, or demagogues embroil
A land—or when the rabble's headlong rage
Order transforms to anarchy and spoil,
Deep versed in man, the philosophic sage
Prepares with lenient hand their frenzy to assuage.

'Tis he alone whose comprehensive mind,
From situation, temper, soil, and clime
Explored, a nation's various powers can bind,
And various orders, in one form sublime
Of policy, that, 'midst the wrecks of time
Secure, shall lift its head on high, nor fear
The assault of foreign or domestic crime;
While public faith, and public love sincere,
And industry and law maintain their sway severe.

Along with the larch and Scotch fir there are also fine specimens of the spruce fir on the peat—which useful and ornamental evergreen tree is not held in due estimation by many who have extensive plantations, but is regarded merely as a nurse for other trees, and are often thinned out before reaching mature age. It is true that in certain parts it requires nursing itself, to make large trees; but in moist and sheltered situations, and in the centre of woods, it becomes a large tree, and grows as rapidly almost as any tree, whether indigenous or exotic. A few testimonials of the character of the spruce may assist to bringing it more into notice than it has hitherto been. Menteath, in *The Forester's Guide*, tells us that the spruce fir is a much better timber tree than what many consider it to be; for, although appearing very knotty and coarse when cut up into boards, it is a most useful kind of wood, and makes most excellent plain deal doors, flooring, and scantlings; and although cut up into thin boards, it neither casts nor twists to the same degree as other kinds do, although a similar result is generally dreaded. In the *Penny Cyclopædia* we are told, when the spruce fir is in perfection—and occasionally it arrives at its greatest perfection in this country—it acquires a stature of 150 feet. Its wood is of a white colour, of a fine even grain, and very durable. In the market it is known by the name of white or Christiana deal.* In the third volume of *The Journal of Agri-*

* Pontey, in his *Profitable Planter*, after adducing evidence of the durability of spruce timber, and of the value of the spruce tree as a nurse to hardwood trees, gives an interesting account of the mode by which he discovered that the valuable foreign 11-inch white deal plank is obtained from the spruce tree:—" In the early

culture, we are informed that the Duke of Athole had an opportunity of witnessing the durability of the spruce, even when young, in posts and rails, which kept free of worms and lasted as long as the larch. But the great trial of the value of spruce, as large timber, was made in 1805, when the bridge was building over the Tay at Dunkeld. At that time fifty or sixty trees, which stood in the way of a new road, were cut down and sawn into planks of 10½ inches. These trees contained from 70 to 80 cubic feet of timber, and they were at least 100 feet in height. These planks were mostly used as caissons under the piers of the bridge, and many were employed as heavy planks, upon which were wheeled earth and stones for twelve years. Planks and posts of spruce were used in the fitting-up of the new stables at Dunkeld. Those trees which were cut down for the planks were much branched down to the ground; but, in cutting up the timber, the effect of these branches was found only superficial, no knots having entered into the wood.

For wood to grow well on peat-moss, the peat should be well drained. Many may be deterred from planting on peat, by witnessing failures in some parts of the country, where abundance of moisture is allowed to remain, both before and after the plants have been put in; but as peat is easily drained, the evil may soon be removed. I may state that the peat-moss in Auchinbowie wood has only a few deep cuts through it, for conveying the water off. Coal has also been worked, and the old pits no doubt draw part of the water away; but, as the peat rests upon a thick bed of clay, the greater part of the water will be taken off by means of the deep drains.

A writer remarks, that peat soil is obviously unfavourable to the growth of trees; and it appears probable that its accumulation in these places is the principal cause which prevents the native seeds from germinating, or the young trees from rooting. There is no evidence of any decided change of climate; and any influential cause arising from such a change is merely conjectural. But from what we know of the past and present state of this and other countries, we may fairly attribute the chief cause of the defective propagation or disappearance of native wood to the change in the

part of the month of December 1808," he narrates, "I had an opportunity of inspecting at Hull, in company with one of the owners, a cargo of timber in the New Manchester, just arrived from Calmar, in Sweden. As the whole had been recently cut, so the bark was perfectly fresh, and left no doubt of its being the *spruce fir*—a fact beyond all doubt, by a branch found on one of the young trees, as fresh as if still growing in the ground. The trees were in general young, small, and full grown; and had they not obviously arrived from a foreign port, I should have supposed the whole of British produce. This circumstance, which clearly demonstrates the species of the *foreign white deal*, will, I presume, evince the propriety and importance of the observations on the properties of the *spruce fir*. To numerous individuals it will be of much importance, not only as it regards the choice of species to plant, but as it puts an extraordinary value upon such as are growing, and, most of all, upon what are now of scantlings sufficient for the common purposes of buildings."—EDITOR.

nature of the surface soil. Moisture, no doubt, is one of the principal causes that prevents seeds from germinating, or young trees from rooting; for we have observed, in several cases, that where peat has only the surface water removed, and without any other preparation, a natural wood soon sprang up.

A few years ago, a birch tree, self-sown, appeared on the south-west corner of a piece of peat-moss that was pretty well drained: its seed had, no doubt, been scattered by the winds; for there is now quite a thicket of young birch trees growing upon the other parts of the same moss. Such cases show that seeds will germinate, and young plants root well, when the peat soil is in a state to receive them.

We are sometimes taught lessons, in a way that is not at all pleasant at the time we receive them, although they may prove useful to us in after life. The planter of forest trees may get instruction even from storms of wind that have dealt destruction among his choice plants,—

> When furious whirlwinds rend the howling air,
> And Ocean, groaning from its lowest bed,
> Heaves his tempestuous billows to the sky,

he may yet find out a remedy to preserve the objects of his particular care from a similar fate. The strong winds of December 1851 laid prostrate many a noble tree that had stood the storms of a hundred winters.

A Scotch fir tree in Auchinbowie wood, that reared its head nearly sixty feet above the surface, was laid low, and in its fall destroyed other trees of smaller stature, before it crushed the luxuriant briers and bramble that lived beneath it. It yielded about 140 feet of timber, and it grew in peat-moss. Among the many improvements which have been made on that estate, in cutting a deep drain through part of the peat that passes near the fir tree, some of its roots were obliged to be cut, which no doubt gave the gale an easier task to upset such a tree, although its roots were closely interwoven with the peat in which they grew; and when the tree fell, its roots displaced upwards of 330 cubic feet of moss.

One circumstance should not be forgotten—as it may be useful to those who have plantations on peat soil, or may yet plant it—that when peat-moss contains a certain quantity of moisture, the roots of plants will not enter it. In the case of the fir that was blown down, hundreds of fibres had reached a certain depth, about 3½ feet; but beyond that depth they would not go, although the quality of the peat was the same—the difference solely consisting in its containing a little more water than that in which the roots lived and obtained nourishment. So remarkable was the repugnance of the fibres to enter the watery portion demonstrated, that they had more the appearance of having grown upon an Arbroath

pavement than upon a moist mass of decayed vegetable matter. The roots of Scotch firs go much deeper than 3½ feet in peat, when properly drained; so that by obtaining a knowledge of the proper quantity of moisture which ought to remain in peat where wood is intended to be grown, an important point will be gained—for many plantations on peat are rendered useless on account of the want of such knowledge; and as draining peat is not so difficult nor so expensive an operation as on many other soils, and where roots are allowed to descend freely, the gale will find a greater difficulty of upsetting trees: finer specimens may in future be grown on peat-moss than have ever yet been, and may be admired for their superior beauty and value in the market. What has been said in reference to other crops on other soils, may doubtless be applied to trees even when cultivated on peat-moss:—

> Without fair culture's kind parental aid—
> Without enlivening suns and genial showers,
> And shelter from the blast—in vain we hope
> The tender plant should rear its blooming head,
> Or yield the harvest promised in its spring.

Peculiar mode of using Potatoes in Norway. By M. Is. Hy. Beer, Flekkefjord, Norway.—The intention of this operation is to alter the flour or starch, which the potatoes contain, into sugar, by a simple process, and thereby render the potatoes more nourishing to animals. The potatoes are at first washed, and then steamed or boiled in the common apparatus which, I presume, most farmers in Scotland possess. When well boiled, the potatoes are to be crushed as *quickly* as possible between two wooden rollers, and immediately put into a wooden vessel or cooler wherein has been poured some water of the temperature of 75° Fahr. The crushed potatoes are then mixed well with crushed barley-malt, 6 lb. malt for every 100 lb. of raw potatoes, the malt being mixed by little at a time, the warmth of the mass constantly maintained not *under* 140° F., nor *above* 155° F. It is very material to keep the said warmth, as it is indispensable to extricate the sugar. When the mass has been well mixed, the vessel must be covered with boards and a blanket, and the mass let stand from two to three hours, and stirred up in that time four or five times, its warmth not being allowed to sink under 140° F.

The mass, when well prepared, is a sweet brownish-like syrup, and is ready for use.

It is advisable to prepare the requisite quantity of potatoes every day as they are wanted, when the air is mild, or at least every second day.

The cooler must always be kept very clean, and therefore, after being used, be washed well with hot water, sprinkled over with a little lime in order to expel the acid, then rubbed and washed

again, and dried with a cloth, letting it stand uncovered exposed to the air till the next time it is wanted.

It is evident that the operation can be executed by any one with a thermometer in his hand; and in fifteen, or at most twenty minutes, two quarters of potatoes can be crushed and mixed, as I know from experience.

Malt is an expensive article in Scotland, on account of the duty; but I presume there can be nothing against farmers making green malt for their cattle. For that purpose it is easily made. A farmer has only to steep barley three days in cold water, lay it afterwards in a heap in a shady place till it begins to sprout, turn it over, observing that the barley on the outside is turned inside of the heap, which should now be laid flat, about 1½ foot high, or less if the weather be mild. When it has sprouted a little more, turn it over again, and so on till the sprouts are a good quarter inch in length. The malt should then be spread very thin, to dry in the air or upon a kiln.

Experience will soon tell that potatoes thus prepared will enable animals to extract more nourishment than from the same quantity of raw or boiled potatoes. The prepared potato mass is usually given, with chopped straw, to cows, oxen, and sheep, and is eagerly devoured by them; and it has been ascertained that a mass of 12½ lb. of potatoes, ⅝ lb. of malt, with 4 lb. of chopped straw, and 4 lb. of hay, are equal to nourish a little Norway cow fully as well as 20 lb. of hay alone.

This method of preparing potatoes was contrived by a man in Norway about ten years ago. It was recommended to the farmers by the Norway Agricultural Society, and has been much used by the more enterprising farmers. The Royal Agricultural Society at Copenhagen has also recommended the method most earnestly, and, at its request, Professor G. Forchhammer has examined the composition chemically; and he states, among other things, that 200 lb. of potatoes, with 12 lb. of malt, gave him 65 lb. of very thick sweet syrup, though the experiment was made in the spring; but that 12½ lb. of potatoes, ⅝ lb. of malt, 4 lb. of straw, and 4 lb. of hay, do not contain so much nitrogen as 20 lb. of hay. The milk from the mass will give little cheese, but much butter; little flesh, but much fat. He therefore recommended to add 2 lb. of oilcake, when the food will be equal to 24 lb. of hay; and he concludes thus, on the 16th June 1842:—"Considering that this operation can be executed by every farmer, with apparatus he is mostly in possession of, I regard it to be of the highest importance to extend this method of preparing a nourishing food for cattle, at so low a price as this, as it will essentially contribute to the welfare of the farmers."

Many reports from different persons in this country, and in Denmark, have since been published, and they have stated that one quarter of prepared potatoes are equal to two of raw or of boiled,

and it is highly recommended by all. One reporter says, "I have given my thirty-six milk cows each 12½ lb. of potatoes, ⅝ lb. of malt, 10 lb. of cut barley and oat straw, and 4 lb. of straw, with no hay, from the middle of December till spring, and they have done uncommonly well. For fattening swine and sheep nothing can be cheaper."

When the method of preparing potatoes in the manner described has been approved of in Norway, where potatoes are dear compared with hay, and where cows can be kept, and oxen and sheep fattened, in the summer on the mountains for almost nothing, and where flesh, therefore, is low in price, and seldom worth more than 1½d. or 2d. per lb., I consider it will pay better in Scotland and England, and, as far as I am able to judge, it will be of considerable service to the United Kingdom, and it will come into general use if it were only tried; for I am persuaded that the farmer who has fed his cattle for only one month, with potatoes thus prepared, will never leave it off. *When the turnips are consumed, the potatoes are still in store;* and these, thus prepared, will be the means of saving numbers of cargoes of oilcakes.

Drying Corn on Poles in Norway. By M. Is. Hy. Beer.—In the south and north country of Norway there falls in the autumn generally so much rain, that it would be nearly impossible to get the corn dry if set in shocks in the field, as is done in Scotland, England, and most countries on the Continent. Other means are therefore resorted to—and one is, to bind the corn on sticks, and it has been in use time out of mind. The corn never gets spoiled, even though it rain for three or four weeks; and one day of dry weather will save the whole crop of corn.

Scotland is also a rainy country; and, as far as I know, the farmers often get their corn destroyed, or at least hurt, by too much rain in the harvest-time. I therefore presume that it would be of some service to the Scotch farmers to be acquainted with the method of setting up corn on sticks.

Though the effect is simple when seen, it is difficult to describe. The sheaves should not be so large as is usual in Scotland, and they should be bound near one end, in order to tie them to the sticks. One person puts the sticks or short poles fast into the ground, by making a hole with an iron pinch, at a certain distance, in rows, to let the carts or waggons pass between. A young person carries the sheaves to the man that binds them on the sticks, who first places three, and sometimes four, sheaves upright on the ground, inclining to and around the stick: two sheaves are then laid horizontally, one on each side of the stick, upon the upright standing sheaves, and tied to the stick, the ear-ends pointing to the north, and divided a little. He then in like manner ties other two sheaves to the stick, with the ear-ends to the south, and

continues tying them, pointing to the south till the stick is full; when he closes with a single sheaf, by putting the stick nearly through it. The sheaves all bend down with their ears, which are divided a little to let the rain run off. The binding of the sheaves to the stick is effected by only twirling some of the straw around it.

By thus dividing the labour it goes expeditiously on, and I think, when the workmen have got accustomed to it, it will not be more expensive than the Scotch method of setting corn in shocks on the field. It might, perhaps, by the first labour be less; but the trouble afterwards, of taking off the cover sheaf, and of lifting off the sheaves after a heavy wind, I presume will equalise the expenses; but remember that the corn is as safe on the sticks as it is in the barn.

The sticks, commonly young trees, are about 7½ feet long, 2 inches thick in the middle, and pointed at both ends. About 1500 to 2000 sticks will serve a farm of 100 acres—the half in corn; and such, perhaps, may be had at a moderate price from the thinnings of the plantations in Scotland. In Norway they can be bought for less than a penny a-piece, and they will last for twenty-five years and more, when brought into a shed after use. The annual loss on them cannot be more than two per cent.

As most Norwegians believe that the best things come from abroad—and, alas! in most cases they are in the right—I tried to set the corn in the field as in Scotland, but had great loss by it, and I shall never attempt it again; so I believe the Scotch farmers, at least in the west and north parts of their country, will gain by following my example.

If it should be desired, I will send a person from this to teach some of the Scotch farmers how to bind the corn on sticks; and as a vessel goes from this to Leith after the spring, it shall be done without any cost to them.*

Drying Clover, Tares, and other Juicy Plants, in Norway. By M. Is. Hy. Beer.—In most situations in Norway it would be impracticable to cultivate forage plants containing much sap for use in the winter-time, if these plants were not dried on a sort of scaffold of different construction, of which I shall describe the best.

I presume it to be of great advantage to introduce such implements as these even in countries having a drier atmosphere. Each scaffold consists of three supporters, placed parallel on the ground,

* The setting of sheaves on sticks instead of in stooks has been tried in this country; and, among others, we know that Mr Irving Boswell did so at Kingcausie, in Kincardineshire, but found the plan attended with considerable trouble. A very similar practice is followed in Sweden as this one of Norway; but in the former country, after the first sheaves are set on the ground, the others are fastened to the sticks by simply spitting them through the sheaves, near the bands, giving the ear end an inclination towards the ground.—Editor.

the ends of which need not be pushed into the ground. Along these supports are laid sticks of 14 feet in length, by 2 and 2½ inches thick. The supporter is constructed of two sticks, each 7 feet long and 2½ inches thick, united at their upper ends, in a sloping position, by a pin being driven through both; and in order to place the sticks upon the supporters horizontally, three nails or pins, 3 or 4 inches long, are partly driven in, at a distance of about 18 inches apart, upon their sloping limbs. To prevent the scaffold falling down by high winds, there must be placed at each end a pole, one end of which is set against the supporter, and the other end thrust into the ground, the supporters being made to incline towards the poles. The scaffold is readily put up to lay the forage plants upon, and it should be set in the direction of south and north.

The laying on the plants to be dried should commence on the lowest stick—and they are most conveniently placed by a fork upon the higher ones—when the whole scaffold appears like the roof of a house. It is best not to make the scaffolds longer than about 26 feet; whereon can be dried in a short time, according to the weather, without further trouble, from 5 to 6 cwt. dry forage—*which will never get spoiled.*

It is, however, to be observed, that the plants should not be laid on before the day after being cut, and best in dry weather; and that those laid on the lowest stick do not reach the ground. It is evident that no method of drying clover, tares, or grasses for seed, can be cheaper and more safe, when the work has been properly conducted. For seed, the ears should be put inward. The fodder is raked together in heaps; one cart takes out the supporters, from which they are set up at certain intervals; another cart takes out the long sticks, and the requisite number to each scaffold is laid along the supporters; one person adjusts them, and two persons, women or children, one at each side, lay the forage on. The expenses for the sticks are a mere trifle; a farmer having, for instance, only to buy a piece or two of timber 14 feet long, and to divide it at a saw-mill in pieces 2 by 2½ inches, and any joiner with an axe and a brace can make them ready. On being brought under a shed after use, they may last for half a century. Never should such an implement be wanting on a farm in the north of Europe.

Upon every farm in Norway the potato leaves are dried and gathered, by laying them on such frames or on houses, upon fences, or wherever they can; and no forage is better for milk cows. A good handful of the forage for each cow is put in a vessel and hot water poured over it, and then let to stand covered till the next day, when the juice and the leaves are given to the cows, upon which they give much milk; and although the dried leaves seem rotten, they are good for the purpose.

Sale of Mr Boswell's Stock at Kingcausie, Kincardineshire.— There is no source of greater pleasure to the mind of a farmer than when engaged in the establishment and progressive improvement of a herd of cattle or flock of sheep on his farm. As superior judgment, taste, and ability, are required to improve stock, than to augment the fertility of the soil, and increase the amount of crops, so in the same proportion is the satisfaction higher, as the farmer brings his animals to a state of perfection that enables him to dispose of their surplus as a breeding stock, than when he has to dispose of a few additional quarters of grain. Confining our observation to Scotland, the number of farmers who have established and maintained a superior breed of stock for any length of time are but few. The late Mr Robertson of Ladykirk, in Berwickshire, was the first to establish a large as well as superior herd of short-horns, and he has been followed in that course by Captain Barclay of Ury and Mr Irvine Boswell of Kingcausie, in Kincardineshire, and by Mr Cruikshanks, Sittyton, Aberdeenshire; while, at the same time, Mr Hugh Watson, Keillor, Forfarshire, took the same course with another breed of cattle—the Angus doddies. Of the task imposed on themselves by all these eminent breeders, Mr Watson had the most difficult to perform; inasmuch as any breeder of short-horns in Scotland could, at any time, furnish himself with a superior male or female, or both, from celebrated English herds; whereas, a superior Angus bull or cow had to be raised upon its own foundation, and such a thing can only be accomplished by great judgment and taste being exercised for an extended period. In tracing the history of particular herds and flocks, of superior character, it will be found that they are indebted for their origin to one single male or female. Many instances of this could be adduced, but the most remarkable we are acquainted with is that of Mr Watson, who still possesses a fine cow which has borne superior calves for upwards of twenty years. The utmost attention is required to maintain the purity of a high-bred stock. When Mr Robertson became infirm in health, his breed had declined in many respects before it passed into the hands of the late Mr John Rennie of Phantassie. Captain Barclay relinquished high-breeding some years ago, and took to crossing. Mr Cruikshanks, being yet comparatively a young man, will yet maintain his stock in high order. Mr Boswell seems determined to retire from the field while his blushing honours are yet thick upon him; and no doubt he does so with a heavy heart, since the parting with a favourite stock leaves a pang akin to losing an old friend and agreeable companion. All who are desirous of possessing blood of the best description and constitution, inured to our northern climate, we would advise to repair to Mr Boswell's sale, and bid like breeders resolved on having nothing but high-bred stock, with a good constitution.

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 6.	40 9	29 6	19 1	28 10	33 11	30 11
13.	40 1	29 2	19 4	29 4	34 5	29 11
20.	41 4	28 9	19 9	30 0	33 2	29 3
27.	40 3	27 6	19 1	29 0	33 11	28 9
1852.						
Jan. 3.	39 9	27 4	19 4	28 6	32 4	28 6
10.	39 7	27 3	19 2	27 4	30 5	28 5
17.	41 1	28 10	19 3	29 6	30 9	27 9
24.	40 7	30 1	19 0	27 6	32 4	27 4
31.	43 1	30 4	19 4	28 0	32 0	28 6

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 3.	39 2	25 5	19 1	31 6	32 3
10.	38 4	25 6	19 5	32 6	33 8
17.	37 11	24 10	19 8	32 2	32 9
24.	38 6	25 1	19 6	30 0	30 6
31.	38 0	25 1	19 2	29 2	29 7
1852.					
Jan. 7.	38 1	25 0	19 1	29 6	30 3
14.	38 11	26 6	19 3	31 2	31 9
21.	39 8	26 2	19 9	30 9	31 4
28.	41 4	27 8	20 10	31 6	32 2

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 6.	38 1	26 1	16 10	26 6	32 6	32 3
13.	37 6	24 5	20 6	27 2	33 1	33 10
20.	38 4	25 11	17 5	27 10	27 3	30 6
27.	38 7	22 7	20 0	28 5	27 6	31 9
1852.						
Jan. 3.	37 9	23 9	18 1	30 4	27 8	30 6
10.	37 6	25 7	16 2	32 1	27 11	30 0
17.	39 11	22 0	18 1	28 6	28 3	29 8
24.	39 3	24 7	19 6	27 9	28 6	29 4
31.	40 1	26 11	18 7	28 2	28 9	31 10

DUBLIN.

Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bere, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour, p. barl. 9 st.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 3.	20 10	12 9	10 1	10 0	13 3
10.	21 2	13 0	10 2	10 6	13 5
17.	20 9	13 9	10 6	10 8	13 6
24.	21 7	13 6	10 8	10 2	13 8
31.	21 6	13 8	10 10	10 1	13 10
1852.					
Jan. 7.	22 5	13 7	11 0	10 6	14 0
14.	22 9	13 1	11 10	10 11	14 1
21.	23 2	13 8	12 2	11 3	14 3
28.	24 4	14 1	12 6	11 1	14 6

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vic., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1851.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 6.	37 6	36 9	27 0	26 7	18 2	18 0	27 6	25 4	29 6	28 5	30 6	29 5
13.	37 5	36 11	26 8	26 9	18 6	18 2	27 2	25 9	30 0	28 11	30 2	29 9
20.	37 7	37 2	26 6	26 10	18 3	18 4	27 4	26 2	29 6	29 1	29 9	29 10
27.	37 2	37 3	26 3	26 9	18 3	18 4	28 1	26 6	29 0	29 3	29 2	30 0
1852.												
Jan. 3.	37 2	37 6	26 3	26 7	17 9	18 3	26 11	27 9	28 4	29 2	28 7	29 7
10.	37 4	37 4	26 5	26 6	17 10	18 2	30 1	27 10	28 1	29 1	28 9	29 6
17.	38 3	37 6	27 1	26 6	18 1	18 1	27 5	27 10	28 10	28 11	27 11	29 1
24.	39 3	37 10	27 10	26 9	18 2	18 1	27 10	27 11	28 8	28 9	28 3	28 9
31.	39 10	38 2	28 6	27 1	18 2	18 1	27 6	28 0	28 4	28 7	28 11	28 7

FOREIGN MARKETS.—Per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1851-52.		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Dec. ..	Danzig	35 6 - 41 0	18 6 - 25 0	15 0 - 18 6	28 6 - 34 0	24 0 - 31 0	22 6 - 30 0
Jan. ..	Danzig	38 0 - 43 6	19 6 - 27 0	15 6 - 19 6	30 0 - 36 0	25 0 - 32 0	24 6 - 31 6
Dec. ..	Hamburg	37 6 - 42 6	24 0 - 29 0	15 0 - 18 0	30 6 - 38 0	28 0 - 33 0	22 0 - 28 0
Jan. ..	Hamburg	38 6 - 43 6	25 0 - 29 6	14 0 - 17 6	31 6 - 38 0	29 0 - 33 6	23 6 - 30 6
Dec. ..	Bremen	35 0 - 41 6	18 0 - 24 6	14 6 - 17 6	27 6 - 34 0	25 0 - 30 0	23 0 - 28 6
Jan. ..	Bremen	37 6 - 42 6	19 0 - 26 6	15 6 - 19 6	29 6 - 36 0	26 6 - 32 0	24 0 - 29 6
Dec. ..	Königsberg	34 0 - 40 6	18 0 - 27 0	14 6 - 18 0	28 0 - 34 0	24 0 - 28 6	22 0 - 28 6
Jan. ..	Königsberg	35 0 - 42 0	19 6 - 29 0	15 0 - 19 6	30 0 - 36 6	25 0 - 30 6	23 6 - 30 6

Freights from the Baltic, 2s. to 3s. 3d.; from the Mediterranean, 5s. 6d. to 8s.; and by steamer from Hamburg, 1s. 3d. to 2s.

THE REVENUE.—From 5th January 1851 to 5th January 1852.

	Quarters ending Jan. 5. 1851.	Quarters ending Jan. 5. 1852.	Increase.	Decrease.	Years ending Jan. 5. 1851.	Years ending Jan. 5. 1852.	Increase.	Decrease.
	£	£	£	£	£	£	£	£
Customs	4,596,705	4,550,512	..	37,193	18,614,880	18,761,069	146,189	..
Excise	3,715,920	3,552,970	..	162,950	13,003,961	13,093,170	89,209	..
Stamps	1,459,721	1,427,485	..	32,326	6,095,641	5,932,549	..	162,092
Taxes	1,923,053	1,185,922	..	737,131	4,360,178	3,563,962	..	796,216
Post-Office ..	152,000	246,000	94,000	..	820,000	1,064,000	244,000	..
Miscellaneous	80,391	70,574	..	9,817	338,552	322,421	..	16,311
Property Tax	418,730	367,956	..	50,774	5,383,037	5,304,923	..	78,114
Total Income	12,346,520	11,401,419	94,000	1,030,191	48,616,249	48,042,094	479,398	1,052,733
	Deduct Increase		....	94,000	Deduct Increase		....	479,398
	Decrease on the qr.		..	936,191	Increase on the year		..	573,335

TABLES OF BUTCHER-MEAT.—Per Stone of 14 Pounds.

Date.	London. Beef.	London. Mutton.	Liverpool. Beef.	Liverpool. Mutton.	Newcastle. Beef.	Newcastle. Mutton.	Edinburgh. Beef.	Edinburgh. Mutton.	Glasgow. Beef.	Glasgow. Mutton.
1851.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Dec. ..	4 6 - 6 9	4 6 - 7 0	4 3 - 6 6	5 3 - 7 0	4 3 - 6 3	4 6 - 6 9	5 3 - 6 3	5 6 - 6 9	5 6 - 6 9	5 9 - 6 9
1852. Jan. ..	4 3 - 6 6	4 6 - 7 3	4 6 - 6 9	5 6 - 7 3	4 3 - 6 6	4 9 - 7 0	5 6 - 6 6	5 9 - 7 0	5 6 - 7 0	5 9 - 7 0

PRICES OF ENGLISH AND SCOTCH WOOL.—Per Stone of 14 Pounds.

ENGLISH.	s. d. s. d.	SCOTCH.	s. d. s. d.
Merino, ...	13 0 to 17 0	Leicester Hogg, ...	10 6 to 16 0
.. in grease, ...	9 6 to 14 0	.. Ewe and Hogg, ...	8 6 to 13 6
South-Down, ...	13 6 to 17 0	Cheviot, white,................	10 0 to 13 6
Half-Bred, ...	10 6 to 13 6	.. laid, washed, ...	7 0 to 10 0
Leicester Hogg, ...	10 6 to 14 0	.. unwashed,........	6 3 to 8 3
.. Ewe and Hogg, ...	8 6 to 12 6	Moor, white,.....................	6 3 to 8 3
Locks, ...	6 0 to 8 0	.. laid, washed, ...	5 6 to 7 0
Moor, ...	5 0 to 6 0	.. unwashed.........	5 0 to 6 0

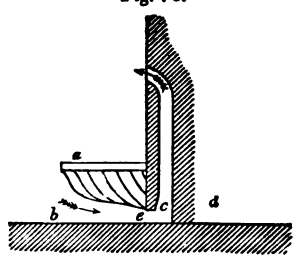
AGRICULTURAL ARCHITECTURE AND ENGINEERING.—No. V.

By R. S. Burn, M.E., S.A., Author of "Practical Ventilation," &c.

(*Continued from* p. 305.)

In concluding this department at present under consideration, we would point out an admirable contrivance, which might with advantage be the adjunct of every fireplace and chimney—we allude to the "dust-draught." Every one has at some time or other experienced the inconvenience of clouds of dust projected into the room every time the hearth has been sweeped or the fire stirred. By the use of the dust-draught this source of unpleasantness can be easily avoided. It may be described as a sort of ventilator, through which the dust is withdrawn from the hearth and projected up the chimney, the ascensional force being maintained by the power of the chimney draught. In fig. 73 we give an exemplification of this contrivance. Suppose *a* to be the grate, *b* the hearthstone, *d* the wall at back of grate, up which a channel, *c*, is made behind the grate, open at both extremities, viz., at *e*, on a level with the hearth, and at the arrow above the fireplace, or, what is better, above the throat of the chimney. The upward draught of the chimney creates a current up the channel *c*, indicated by the arrows, quite sufficient to remove continuously all dust floating in the neighbourhood of the hearth or grate. In one case, where a temporary contrivance of this kind was adopted, viz., a tin tube, placed behind the grate, and opening out at its lower extremity on a level with the hearth, and its other point above the fireplace, the draught was such, that when the floor of the room was swept, the dust raised thereby—at least 4 feet from the fireplace—was drawn along the floor and up the tube into the chimney. Those who value a clean room, free from coal-fire dust, will at once appreciate this plan. The size of channel for a moderate-sized house will be ample if of 2 or 2½ inches diameter. It may be formed, if more convenient, of zinc or cast-iron pipe. The opening into the chimney should be at least 2 feet above the chimney throat. Means may be provided by which the channel could be shut up, so as to stop the upward current when not required to be in use.

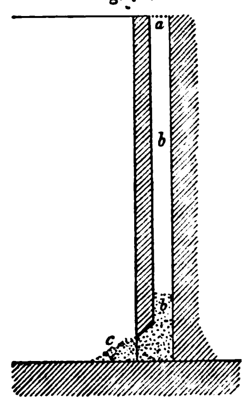
Fig. 73.



In houses provided with an underground cellar, channels may be made, communicating with these and the hearth of the kitchen fireplace—a grating with small interstices being put beneath the fireplace bottom bars. The cinders falling on this grate can be easily removed, to be burned again, by merely agitating the mass

lying on the grating; the ashes falling through the interstices and passing down the channel to the cellar underneath, from whence they can be easily removed at convenience. In fig. 74 this arrangement is indicated. *a* is the grating beneath the fireplace, *b b* the channel made in the brickwork of the wall, communicating with the cellar floor at its level *c*. The bars of the grating should run at right angles to the line of the chimney breast, as this will facilitate the removal of the cinders, the shovel used for lifting them gliding smoothly along, and not entering the interstices, as would be the case did the bars run in the opposite direction.

Fig. 74.

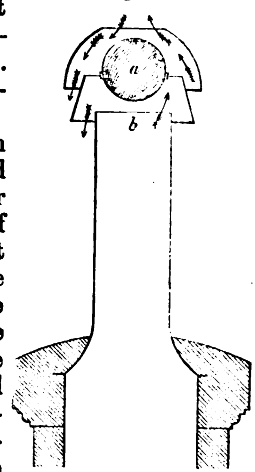


In addition to the means adopted in the construction of fireplaces for obtaining warm air to the interior of the living apartments, as already detailed, warm-water pipes may also be used. In the prize cottages of the Society of Arts the following plan is adopted. The floor of the scullery is two steps lower than the floor of the living room, which will allow of the circulation of hot water from the boiler of the scullery to a coil of pipes placed on the floor of the living room; and this coil is proposed to be fixed in a recess or chamber formed by the side of the fireplace. Into this chamber fresh air is admitted by a flue, built in the external wall, and opening into the chamber underneath the floor, the external aperture being about 7 feet from the ground. A constant supply of warm air would by this means be admitted into the living room through the regulator in front of the hot-air chamber. An alteration in this plan may be suggested here, viz., to remove the hot-air chamber to the utmost possible distance from the fireplace. There the heat will be diffused more equally throughout the room, the hot air being admitted at a part where the influence of the fireplace heat would be less marked. If a boiler be attached to the side of the fireplace in the living room or kitchen, it may be made available for heating a small coil of pipes placed within a neat case standing on the hearth on the bedrooms above. A very small boiler would suffice to keep up a genial heat in the bedroom, and at a mere trifle of expense.

While in this department, we may here notice a very efficient "wind-guard," known as Welch's patent Globe or Common Sense wind-guard. We give it as being useful in such cases where wind-guards are necessary, as detailed in the latter part of our last article, (p. 304.) In fig. 75, we give a section of chimney-top and wind-guard. *a* is a sphere of metal, revolving on its axis, so that it can be relieved of its adhering soot. The smoke escapes usually as indicated by the arrows on the right hand; and when the wind blows

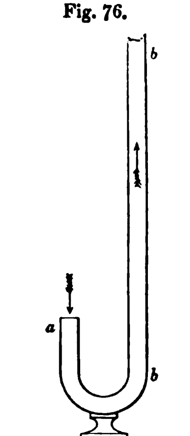
down, it causes the smoke to pass away in the direction of the arrows on the left hand. In any case the wind cannot affect the smoke until it has left the pot at *b*, when, of course, it must be dispersed abroad, and not down the chimney. In principle this appliance seems to be comparatively perfect.

Fig. 75.



In former numbers of this Journal, and in our volume on the subject, we have entered so fully into the essentials requisite for obtaining and maintaining a good supply of fresh air in the interior of apartments, that we consider it unnecessary to take up space here by detailing them again. There is one plan, however, which we think well to notice very briefly in this place, inasmuch as in none of the numbers of this Journal, above referred to, any notice was given of it, from the circumstance of its not having been at that time introduced into successful practice. The plan we allude to is what is called the "Air Siphon Ventilation," and is, we deem, alike remarkable for its novelty, simplicity, and effectiveness. We have recently subjected the principle to a most rigid set of experiments, both in the large and small scale, and under a great variety of circumstances; and, however much we may be disposed to carp and quibble at the theory which professes to explain its action, we cannot shut our convictions to the fact, that in practice it is eminently successful. From what we know of it, we feel justified in promising, to those who may fit it up with a due regard to its principles, considerable satisfaction as to its efficiency. A slight notice of it may now be given, exemplified by a few illustrations showing the method of fitting it up. It must first be premised that, in all cases of its adaptation, care must be taken to carry out means for supplying all the apartments with *fresh* air—for which, see directions in our paper on ventilation in a former number of this Journal. We may also state that the system has been patented, but for England only.

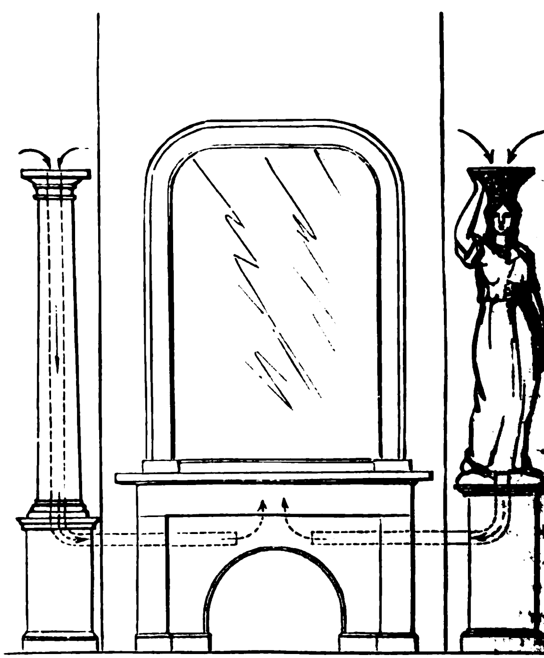
Fig. 76.



Suppose a siphon, as in fig. 76, to be erected, having the long leg *b b* very much longer than the short one *a*. Now, on examination, a current will be found always going down the short leg *a*, and, by consequence, up the long one. Were it necessary, we might give the patentee's theory by which he explains the reason of this current being established in any siphon, wherever placed, in which one leg is much longer than the other: it is suf-

ficient for us to state that, in all cases where we have seen the plan tried, there is a current down the short leg established, in a decided manner, which it would be most sceptical to doubt. Now, in the application of this plan to the ventilation of an apartment, it fortunately happens that, in the majority of instances, there are chimney flues. Thus there is generally presented a long leg of the siphon *already made:* all that is necessary is to establish the short one, and the current is at once created. In this plan of taking the chimney of an apartment as the long leg, it must not be supposed that it is because the heated air in the chimney is made serviceable in creating a current: it is because there is a ready-made channel, which obviates the necessity of constructing another, and because it is capable of serving a double purpose when fire in the apartment is required, as in winter; and is conveniently available for the single purpose of ventilation when fire is *not* required, as in summer. There is, moreover, another advantage obtained in thus using the chimney flue as the long leg of the siphon; we add the ascensional current in the chimney to that of the siphon, and thus in winter the ventilating current is increased in force. In fig. 77 we give an exemplification of the method of adapting this plan to an apartment in which there is a fireplace and chimney. It is, however, to be noted that, in all cases, the formation of the siphon must be perfect—that is, the short leg to enter the chimney flue above or near its throat. The illustration will make plain the method of applying the principle ornamentally. The figure to the right of the sketch, and the pillar to the left, are both hollow. The air

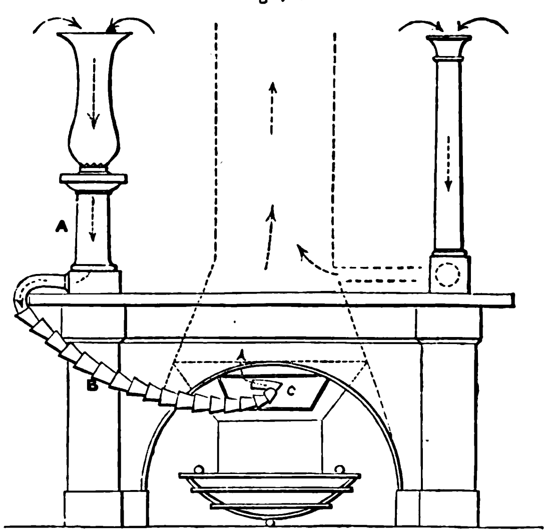
Fig. 77.



gains admittance to these through apertures in their tops. The

pipes, forming the communication between these and the chimney, are shown by the dotted lines, and open out into the chimney just above the flap of the register grate. The long leg is formed by the chimney; the figure and pillar form respectively the short ones. Now, whether there is a fire in the grate or not, down the short legs, and up the long one or chimney, there is a continual current. It must, however, be remembered that, where new grates having register valves are *not* used, but merely the old-fashioned ones having wide openings into the chimney, it is absolutely essential that the tube or channel forming the communication between the short leg and the chimney should open into the chimney at least one or two feet above the throat. If this is not done, it is very evident that the *continuity* of the siphon will be broken. In fig. 78 we give another illustration. The long hollow pillar, placed on the mantel-piece to the right of the sketch, forms the short leg; the contrivance to the left of the sketch shows a method of adapting a "portable ventilator," which may be used in sick-rooms, &c. A hollow (ornamental) vase or pillar A is placed on the chimneypiece, and having a communication at the lowest part by means of a metallic flexible tube B with the chimney; the tube descending and passing in at the opening of the fireplace, and up through the aperture in the "register valve" *c*. The bend or elbow visible in the figure might be carried up into the opening of the valve, and the tube suspended by it; the elbow does not interfere with the free passage of the impure air into the chimney. If there is no fire in the chimney, a smoke-board should fill up the fireplace as air-tight as possible, and the bend of the flexible tube passed through a hole made therein, near the floor. Where a register grate is used, in any case the valve should be closed when there is no fire in the grate, leaving the only communication between the room and the chimney to be made by the short leg of the siphon. A ventilator may be made easily removable by

Fig. 78.



adopting the plan as in fig. 79, a channel *a* being cut in the chimney breast, (the under side at a level with the chimneypiece,) communicating with the interior of the chimney; a hollow pillar *b* standing on the chimneypiece may be placed in communication with this by the small tube *c*: on removing the pillar *b*, the aperture may be filled up with an ornamental plug or cover. In fig. 80 we give a sketch, showing how the system may be carried out by making *special* channels in the wall; the only part seen being the apertures placed near the ceiling, through which the impure air is withdrawn from the apartment. The fact that heated, and even hot air, descends through the shorter branch of the siphon, and is discharged by the long, gives facilities for ventilation of easy adaptation in almost every case where desiderated. This facility of adaptation is more peculiarly observable in plans for withdrawing the products of gaseous combustion from apartments.

Fig. 79.

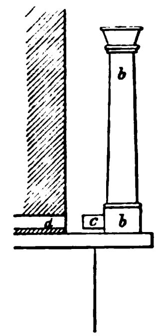


Fig. 80.

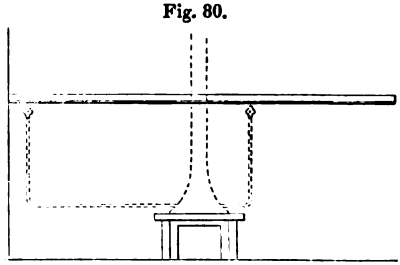
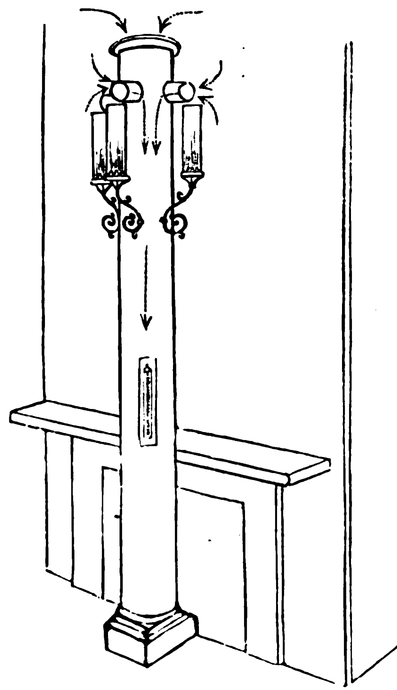


Fig. 81 represents a pillar, forming the short branch of the siphon, communicating at its foot with the chimney or long leg. To the pillar, as seen in the engraving, branches with argand gas-burners are attached, furnished with glass cylindrical shades. Attached to the pillar, and standing out from it at right angles, are small tubes; the outer and lower edges of these are placed in contact with the inner and upper edge of the glass cylinders. Thus arranged, the communication between the cylinders and the interior of the large tube forming the short leg of the syphon is made complete. The current established down the leg carries the products of combustion from the cylinders along the short lateral branches, down the short leg, and finally discharges them up the chimney. To test the efficiency of this arrangement, we have repeatedly placed pieces of paper immediately above the lateral tubes—in fact, in close contact with the upper side of these, and not the slightest discoloration could we detect, even after lengthened juxtaposition. As the temperature of the air passing down the short leg is increased, the velocity of the current is increased in proportion. This we have had repeated opportunities of testing, by placing a thermometer within the tube, witnessing its variations through a plate of glass placed air-tight in the side of the tube. The top of the tube may be left open, and the air is withdrawn through it also, although slightly affecting the velocity of

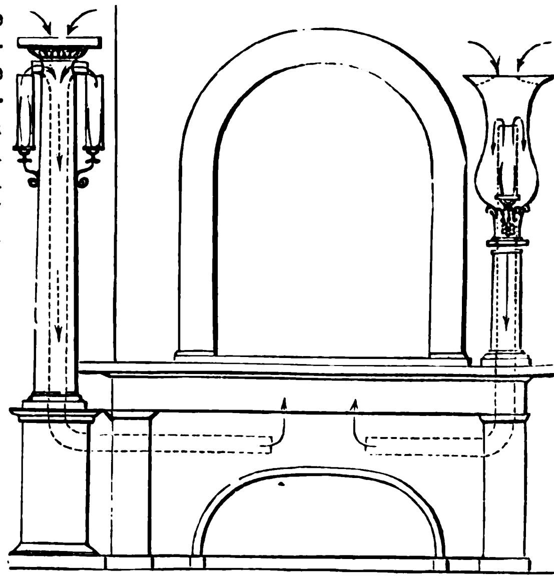
the currents through the lateral tubes. The body of the tube forming the short leg, if of metal, in time gives out a considerable degree of healthy radiant heat. If this advantage is not desiderated, the tube may be formed of non-conducting materials. Where ornamented appliances are required, any form can be easily carried out, as in fig. 82. The descending branch might be formed in any way most convenient. Gas-burners of other forms may, by suitable adaptations, be used with similar results. A vase-shaped glass may be added to the short leg of the siphon, thus becoming an elongation and portion of it, and have within it a burner with the usual glass chimney. In this case, arrangements must be made to supply the burner with fresh air; and this must be independent of the descending current. The heat and products of combustion descend with that current, and pass off by the long leg. By either of these arrangements, with the lateral tubes, or with vase-shaped glass, the products of combustion are not only carried away, but the orifices present efficient and capacious channels for ventilating the apartments. In fig. 83, an idea may be derived as to the method to be adopted in applying the principle to the ventilation of school-rooms, &c. &c. in a cheap and simple form. The tubes should communicate with the chimney above its throat, if a fire is used in connection therewith; if not, a chimney-board must close up the fireplace very tightly, and the pipes of communication pass through holes made in this: the siphon will thus be made very efficiently. From what we have given on this point, we trust to have made it plain that, with the aid of this principle, currents in any direction may be readily made, by which the impure air from any apartment, however situated, may be easily removable, and its applications, moreover, made in strict accordance with the requirements of architectural orna-

Fig. 81.



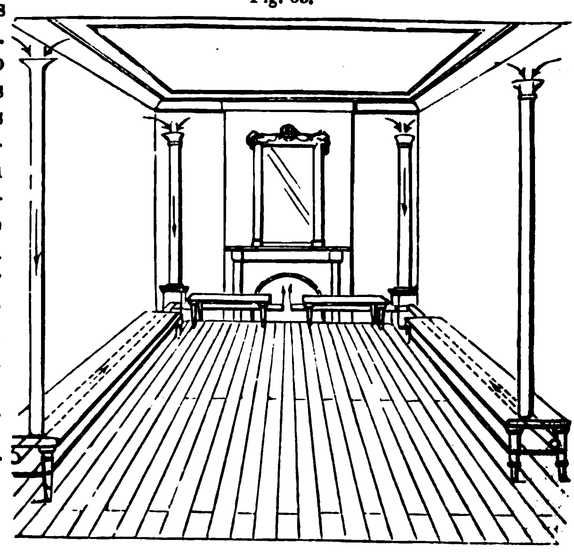
ment. The plan, we may note, in conclusion, has been carried out in numerous cases with marked success. We have considerable confidence in recommending the adoption of the plan, and should like much to hear of any of its successful applications in the agricultural districts of Scotland.

Fig. 82.



Having now treated on certain preliminary and important points, we are prepared to take into consideration the arrangement and construction of dwelling-houses and cottages. As prefatory to our descriptions of the various kinds of materials used in house-construction, and the most improved methods of using them, so as to attain effective, economical, and *safe* structures, we shall consider the important subject of "*Arrangement*," so as to obtain the essential requisites of comfort and convenience at the least possible outlay of

Fig. 83.



material. In this section, plans, elevations, and sections of the various kinds of structures will be comprised.

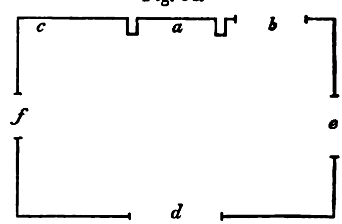
And first, in the arrangement of the house, the essential point of *light* should be well considered. Good aspect for the rooms in which the inhabitants spend most of their time, is of great importance; but it is very evident that all advantage in this respect is completely lost if due means are not taken to allow the light in unlimited quantities to have free access to the rooms. The importance of a good supply of light has been long overlooked, and it has only been within a very recent period that the subject has at all been considered. The result of the investigations on light has proved that a close and intimate connection exists between it and the performance of the higher functions of animal and vegetable existence. Plant a pea, for instance, in a dark cellar—what is the consequence? It takes root, and grows, doubtless; but the shoots it throws out—are they vigorous, and possessed of that healthy green colour, the effect of the existence of healthy juices? No. Pale and sickly, the plant droops—growing still, but never arriving at fructifying maturity. As with vegetable, so with animal life. In many of our large towns are dark cellars and rooms, lanes, and alleys, in which the glorious light of day never enters, which are inhabited by wretched beings; the grown-up, pale and sickly—the young, stunted and deformed. And not the less marked or decided is the state of things in this respect, as witnessed in the country districts—windows few in number, and so miserably deficient in size that all the light admitted only serves to make "the darkness visible." To one who knows the effect of light upon health, such specimens of ignorance on the part of our cottage builders is calculated to give extreme pain. It is easy to blame the window-tax for this state of matters; but, much injury as the tax has really done to the interests of sanitation, it is wrong to blame it as the cause of neglect in this point of cottage architecture. Cottages are rarely designed to have the number and size of windows which made the house liable to the window-tax, so that really the parsimony or ignorance of the builder must alone be blamed. Mr Ward, of London, has been instrumental in drawing much attention to the influence of light upon health. In his examination before the Health of Towns Commission, he stated that, during a practice of thirty years in a densely populated neighbourhood, his attention was repeatedly drawn to the influence of light, not only as a most efficient means of preventing disease, but likewise as tending materially to render disease milder when it occurs, and more amenable to medical and other treatment. And he also gave the following remarkable illustration:—Dupuytren, a very celebrated physician of Paris, mentions the case of a lady whose remedies had baffled the skill of several eminent practitioners. This lady resided in a dark room, into which the sun never shone, in one of the narrow streets

of Paris. After a careful examination, Dupuytren was led to refer her complaint to the absence of light; a removal to a cheerful situation was recommended, and attended with beneficial results, her complaint completely vanishing. Dr Edwards instituted a set of experiments, which serve to show the importance of a supply of light. He proved that if tadpoles are nourished with proper food, and exposed to the constantly renewed contact of water, in order to maintain their beneficial respiration, but entirely deprived of light—although they continue growing, their metamorphosis into the condition of air-breathing animals is arrested, and they remain in the form of large tadpoles. It is during childhood that the evil effects of want of light is most directly influential in acting injuriously on the full physical development. "The strength and constitution of the man is very much dependent on his early rearing during childhood. Whatever stints the growth of a child must operate on his physical capacity for labour." The want of light exercises another influence worthy of being noted—a moral one. This is so self-evident that the statement scarcely requires a proof. "The more dark corners you have in the dwellings of the poor, the greater amount of filth and dirt;" and their sure concomitants, we may add—carelessness and disease. There is every inducement, in an ill-lighted house, for the inhabitants to become careless and indifferent as to personal and household cleanliness.

With reference to the amount of light to be admitted to a room of given dimensions, it is difficult to give an exact rule. If the means of easily modifying it can be attainable, we can scarcely conceive of there being too much light. Sir William Chambers, the eminent architect, generally added the depth and height of the rooms on the principal floor together, and took one-eighth thereof for the *width* of the window. The height should be double, or a very little more so than this. The height of the windows in other storeys, if any, is increased in proportion; but the width of all remains the same as those below. An important thing to be guarded against is, making the sill too high from the floor. In sitting-rooms, the nearer the floor the better. In kitchen windows, the height will require to be at least 2 feet 9, as the kitchen-dresser is, or should be, placed against it. This also should be the height of that in the scullery, as the slop-stone or sink is placed there. But, with these two exceptions, the windows, in the generality of cases, should be placed near the floor. Windows with sills at a distance from the floor contribute more than anything to make a room look cheerless and dull. When sitting, the view is entirely limited—in town, to the tops of the neighbouring houses, with all their charming variety of chimney finishings; and in the country, to the tops of trees or the sky above. We are strong advocates for making the most of things. If the sight of "Nature's lovely garb" is beneficial morally and physically, why deprive ourselves of it by the foolish-

ness of our constructive arrangements. It seems to us passing strange, that man should sigh so much for the green fields around him, and at once proceed to box himself up in a half-lighted room, "cribbed, cabined, and confined." If it is objected to this decided mode of settling the height of window-sills, as being opposed in some cases to the rules of strict architectural practice, we can only meet it by expressing an opinion, that the sooner all architectural styles are brought to act in accordance with the dictates of the science of living, the better; and if this test cannot be submitted, the styles should be laid aside as unfitted to the requirments of modern science. Elegance of appearance, and appropriateness of style, is doubtless a desideratum; "but the designer who would sacrifice any portion of efficiency merely to please the eye, cannot, in our opinion, be commended for his judgment." The arranging of windows with relation to fireplaces is of considerable importance. Not far from the place we write, there has been a large house lately constructed, in which the following absurdity has been perpetrated. In fig. 84, *a* is the fireplace, *b* the window; the corner *c* is so dark that the articles in the cupboard there placed can scarcely be seen in clear weather; in thick or misty, they are nearly altogether invisible. But another, and even worse, fault is to be found with this arrangement. The fireplace from the deep jambs is thrown quite into the shade; and the result is, that all cooking processes are carried on with great difficulty and loss of time. If the window had been placed at *d*, the fault would not have been so egregious as in the former case, yet bad enough in some respects, as the cook would be standing with her back to the light; and if the window had an aspect favourable to the sunlight's easy entrance, the fire would be flooded with the light and easily put out. The best position for the window would be at *e* or *f*. Such matters as these are worthy of consideration: they, in fact, constitute important points, on which materially depends the comfort and convenience of the house. Before a house can be arranged consistent with domestic convenience, it is absolutely essential to know what these conveniences are. A want of this knowledge is the cause of so much money being absolutely thrown away in building houses, presenting, in point of fact, almost everything to render housekeeping a source of annoyance and continual trouble. We are writing now in a district where there are many country villas, and large houses, yet it is no difficult matter to point to many which are, in "little things," so called, miserably deficient. Houses are made to live in, not to look at.

Fig. 84.



The placing of the *doors* of apartments depends much upon the

local arrangements of the buildings. As a general rule, it may be noted, that they should never be placed near the fireplace, or where the bed in a bedroom is to be placed. The middle of the wall is the best position for doors; but the grand point to be noted is, that they should be placed in relation to the windows, that currents of air can be easily established thoroughly from apartment to apartment. The usual proportion of doors is the height twice the breadth, or a double square, as some term it. It is, however, erroneous to suppose that the proportions of a door are to be found thus: there are peculiar constructions which require peculiar measures. On this point we may quote, from good authority, the following remarks:—"With respect to the height of doors in the aperture, there is a universal rule in reason, though not observed. There is a certain height, below which they must not be; though, for dignity and proportion, the field in which they may exceed is almost unlimited. The human stature is the mark for the least height that can be proper: he who makes a door, is not to descend below this established proportion. For the lowest door, then, the height must be such as that a man of the highest common stature may go through it without stooping. This limits the measure to six feet. Below this, the door of no house should be made, even of the plainest; but all above is left to fancy, guided by the general idea of proportion. The height being thus determined, the breadth comes into consideration. The sides must be so distant, that they may not reduce a man to enter with his arms in any particular posture. As he is to go in without stooping, so he ought to be able to walk in at ease. The smallest dimensions in breadth that can be allowed is 3 feet; and this being half of the given height, has a very good effect in respect of general proportion." The principal or entrance door may be from 3 feet 6 to 6 feet broad, and from 7½ to 8 feet high; those in the interior may be from 2 feet 9 to 3 feet 6 broad, and from 6 feet 6 inches to 7 feet high. Entrance-doors are varied in proportion to the general size of the front of the house. Where the frontage is much greater in length than in height, the breadth of the door must be proportioned, so as to be a little too much for its height. Where the height of frontage exceeds the length, the converse of this rule is to be adopted. Entrance-doors should not be placed on a level with the surrounding ground, but approached by one or more steps. This will throw the floor above the level of the ground, which should always be the case in good constructions. The width of a door should exceed the just proportion of its height, in the ratio of its elevation above the ground. The hanging of doors should be carefully considered. Where the door is in a corner of the room, the hinges should be at the side nearest the wall, so that the door when open will lie along the wall. When in the centre of the room, the door should be hinged so that, when open, the light from the window shall fall on its

outer face. On a party entering the room, he can not only see, but be seen by those in the apartment; if, on the contrary, it is hung the other way, on the door being opened the party entering is thrown into shade. In some instances two rooms are divided, and made into separate apartments, by means of folding-doors, forming, when shut, a wooden partition. When these are thrown open, they are exceedingly awkward, projecting into the room at right angles to the wall. To avoid this, the walls on either side should be made hollow, to receive the doors—these sliding upon metal surfaces, by which the movement in and out is much facilitated. Where a door communicates with a small room, as a closet, dressing-room, or bath-room, entering from a large room, the door should always open into the latter, there being too little space in the small one. All these matters may seem of little moment; but as they tend to minister to our domestic comfort and convenience, they are worth attending to.

In *planning* out a house, the grand requisite to be attained, is the obtaining the utmost possible amount of convenience out of the least possible amount of space, and consequently material. And it may be accepted as a general truth, that it is as easy to attain this as not. Of course it is necessary that considerable attention be paid to all the details of arrangement. That this consideration is very rarely given, seems to be the rule, if we may judge from the vast number of houses built every day, in the arrangement of which no attention whatever seems to have been paid to the methods by which domestic comfort and convenience could be obtained. In a matter of such importance, it is really a pity to see the evidences of so lamentable an ignorance in such profusion around us. With many it seems to have been the all-prevailing idea that shelter only was needed, comfort and labour-saving conveniences being altogether ignored. Despite of all the talk there has been of late years about improved arrangements necessary to insure, not only health and comfort, but, what is of far greater importance in a social point of view, morality and decency, we seem to be as far from perfection as ever—at least so far as the houses of our people, whether these be agricultural or manufacturing, are concerned. Pity it is that this should have even a *shade* of truth in it, surrounded as men are by the lights of science. These remarks, be it noted, are more particularly applicable to constructions adapted for labourers and the working-classes. In the neighbourhood of the place we now write, there are houses—so called—in which there is not the slightest tittle of evidence that the designers had for one moment in view the requirements of either comfort or economy, not to notice at all those of morality or decency. In all respects they are libels on the humanity of our nature. The rule seems to be — get the best rent for the houses, at the least possible outlay in building them. Bricks and mortar with some are of infinitely more value

than the health and morals of those for whom the erections are intended. It affords matter of extreme thankfulness to those who are really interested in the welfare of our labouring population, that those "whose lines are cast in pleasant places" are doing much to ameliorate and improve their disastrous condition. Before the minds and habits of the people can be improved, it is imperatively necessary that their physical amendment should *precede* all other measures. The physical condition of the labouring classes has been justly called by Mr Mills the great economic question of the future; and in no way can it be so efficiently ameliorated as by the improvement of their houses. To judge by the too well-defined line of demarcation made between houses paying comparatively high, and those paying low rents, it seems as if there were two codes of morality existing, in which the requirements of each had to be studied by builders when applied to the arrangement of houses;—just as if the prevailing idea with them was, that if the considerations of delicacy and refinement of feeling evidenced, and cared for by the inhabitants of houses of ten, fifteen, twenty, or a hundred pounds' rent, rendered certain domestic arrangements—as *separate sleeping rooms*—absolutely necessary, that these were not at all to be noticed as essential in houses of those who had merely to pay a matter of two, three, four, or six pounds of rent;—the rule apparently being, that outward morality or decency can only be insured in proportion to the amount paid for it; that the rich and wealthy can desiderate these points; but that the poor and indigent, being poor, have no right to think of them, far less claim them as a right. And the misfortune of the thing is, that just as this most unchristian principle is carried out, so does it tend to bring down the standard and efficiency of the mind with those unfortunate people who are chiefly subjected to its influence. So long as builders and house-proprietors make money the *only* standard by which the amount of decency and comfort is to be measured, so long will the real amelioration of the working-classes be retarded. Now, with such, it is of no avail to tell them that improved constructions make improved morals: the distinction is not obvious enough to influence them to bring out a better state of things. But to tell them that improved constructions bring better rent, and that those improved constructions can be obtained by no greater outlay of money than is necessary to make bad ones, we at once place before them a tangible motive, which may work for good. The fact is quite notorious, that the working-classes rush from badly arranged houses to those where convenience and comfort are to be had; that good houses in this respect never want good tenants, even although a little higher rent is demanded. Raise the quality of the accommodation, and you at once raise the moral and social worth of the inhabitants. This question, we deem, requires no detailed proof.

ON THE CLIMATE OF THE BRITISH ISLANDS, IN ITS EFFECTS ON CULTIVATION.

By THOMAS ROWLANDSON, C.E., F.G.S., London.

(*Continued from page* 290.)

Different annual quantity of rain, and difference in the distribution of rain.—Perhaps no better mode could be devised of exhibiting the different amount of rain in various localities than that to be seen in the *Physical Atlas* of Berghaus, as published in its English form by A. Keith Johnston of Edinburgh. The two principal features of his hyetographic or rain map of Europe are marked—the one by different shading, called the isohyetoses, or curve of equal amount of rain,—and the line of isotherombroses, or line of distribution of summer, autumn, &c., rain.

The isohyetoses of 35 inches French,* or 37.3 inches English, include the Hebrides and adjoining coast of Scotland, and in Ireland and England form a curve from the mouth of the Shannon, including the counties of Kerry, Cork, and the western part of Waterford, in the vicinity of the Cummerah Mountains, crossing St George's Channel, and including the whole of Cornwall and part of the western district of Devon. The line of 30 inches French, or 32 inches English, in Scotland is almost solely confined to the counties of Caithness and Ross, with a portion of the northern and western parts of Inverness. In Ireland and England, the same line commences at Lough Foyle, gradually inclining to the southward, until it passes across the Irish Sea to the south of Belfast, when it rapidly descends to the Isle of Anglesea, and proceeds to the westward, along the borders of the Irish Sea to Liverpool, from which it bends towards the borders of Wales and the adjoining English counties to the vicinity of Bristol, from which point it takes an easterly direction, crossing through Hampshire, a few miles north of Portsmouth, and passes into the Channel near Dover. The line of 25 inches French, 26.7 inches English, includes the whole of the north of Ireland to the north of the line just described, and in Scotland commences at the eastern borders of the Isle of Skye, from which point it descends to Glasgow; from whence it takes a nearly straight southern line by Carlisle, Kendal, Lancaster, Manchester; from which latter place it takes a circular sweep to Oxford, from which point it passes south of London to Sheerness; from Sheerness it takes a northern direction up the middle of the Channel and German Ocean to the latitude of the mouth of the Humber. The parts of

* Fifteen French inches are equal to about 16 English inches.

England and Scotland between the northern and southern isohyetosal lines of 26.7 inches just described, have an average rainfall of 24 inches, and the number of wet days amount to 152: of the whole rain, 25 per cent in this district falls during the summer months. In the district of 26.7 inches annual rain-fall, there are 208 wet days, and 20 per cent of the annual rain falls during summer. With particular exceptions, to be noticed hereafter, these lines of equal rain just described, agree pretty well with the observations made in different parts of England, as will be immediately perceived by comparing the annual rain-fall of the following places, with their respective situations on a map of the British Isles:—

	Inches.		Inches.
North Shields,	26.200	East Retford, Nottingham,	25.78
Carlisle, Cumberland,	31.280	Birmingham, Warwickshire,	26.
Whitehaven, do.	49.207	Hereford,	26.
The Flosk, do.	53.	Cirencester, Gloucester,	28.970
Cockermouth, do.	46.930	Empingham, Rutlandshire,	24.610
Keswick, do.	62.202	London,	25.
Eunerdale Lake, do.	76.880	Epping, Essex,	23.650
Lowe's Water, do.	69.542	Epping, do. (average,)	19.500
Buttermere, do.	87.48	Uckfield, Sussex,	25.030
Wartdale Head,	10.55	Stratton, Cornwall,	40.890
Gatesgarth	124.13	Helston, do.	37.800
Scathwaite, Borrowdale,	151.87	Culloden, Scotland,	25.586
Brougham Hall, Westmoreland,	35.	Arbroath, do.	28.211
Grasmere, do.	121.08	Kelso, do.	24.442
Langdale Head, do.	136.	Merchiston, do.	21.270
Kendal,	53.346	Applegarth Manse,	30.320
Bolton-le-Moors, Lancashire,	48.110	Dumfries,	36.9
Cartmel, do.	53.665	Largs, Ayrshire,	43.5
Lancaster,	40.	Castle Toward, Argyle,	56.
Rampside, do.	40.289	Glasgow,	33.
Manchester, do.	37.394	Dalkeith,	25.
Liverpool, do.	36.	Edinburgh,	24.
Erthwaite Lodge, Lake district, Lancashire,	84.	Crawley Springs, near Edinburgh,	36.
Doncaster, Yorkshire,	29.198	Greenock,	39.
Leeds, do.	25.586	Loch Lomond	52.
Ackworth, do.	25.	Aberdeen,	28.66
Derby, Derbyshire,	24.	Fochabers,	26.
Highfield House, Nottingham,	29.595	Elgin,	24.
		Isle of Man,	37.28

A remarkable exception to the general law previously laid down is found within the isohyetosal line of 26.7 inches, which, though strictly applicable to the inland parts of England, do not at all apply to the western parts of south Scotland, particularly adjacent to the Solway Firth, the Isle of Man, the Lake district, and Lancashire. The most marked exceptions are, however, to be found in the mountainous region of south Scotland, the Lake district, and the mountains bordering the counties of York and Lancaster. In these places, the mountains appear to have the effect of causing rains as heavy as those frequently found in the vicinity of the tropics, which heavy rains have a most marked effect on the character of the climate of the adjoining districts.

The annual fall of rain in North and South Wales is also much greater than that indicated by Berghaus's isohyetosal curves; and the same remark applies to the mountainous districts of Kerry, West Cork, and Waterford, in Ireland. It may be here observed that these isohyetosal lines are only intended to apply to districts comparatively level, and at least at a moderate distance from mountain ranges. The same remark applies to the mountainous district of Devon and Cornwall. If, also, it is observed that the rain-fall in the driest part of England averages more than 24 inches, it must always be borne in mind that many places in the central part of England are elevated some hundreds of feet above the level of the sea. The wet climate of mountainous districts is attributable to several causes, partly in consequence of increased radiation and lowering of the temperature, which has the effect of lowering the temperature and thus condensing the aqueous vapours brought up from the Atlantic, and precipitating them in the form of rain. From their elevation, mountains are more calculated to catch the upper, or that current of the atmosphere which flows from the equator to the pole; and the greater evaporation which takes place on mountainous districts has the effect of producing cold and inducing rain.

The wide difference between the fall of rain on level districts, and that found among mountains, will be easily perceived by perusing the following tables of the rain-fall in the lake district, and on the lines of the Rochdale and Peak Forest Canals:—

Fall of Rain in the Lake and Mountain Districts of Cumberland and Westmoreland in the year 1848. By J. F. Miller, Esq.

No.			Rain in inches.	Wet days.
1.	High Street,	Whitehaven,	47.34	210
2.	Round Close,	Whitehaven,	46.70	210
3.	St James's Church steeple,	Whitehaven,	36.34	210
4.	The Flosk,		60.82	207
5.	Cockermouth,		52.37	228
6.	Keswick,		47.06	196
7.	Bassonthwaite Halls,		66.40	229
8.	Gillerthwaite, Ennerdale,		97.73	”
9.	Loweswater Lake,		76.66	217
10.	Foot of Crummock Lake,		98.07	207
11.	Gatesgarth, Buttermere,		133.55	”
12.	Eskdale Head,		70.38	”
13.	Do. Centre of vale,		86.78	205
14.	Wastdale Head,		115.32	243
15.	The How, Troutbeck,	Westmoreland,	91.34	201
16.	Ambleside,	Westmoreland,	76.82	”
17.	Langdale Head,	Westmoreland,	130.38	212
18.	Scathwaite, 6 inches above the surface,	Borrowdale,	160.89	232
19.	Do. 8 do. do.	Borrowdale,	157.22	232
20.	Stonethwaite,	Borrowdale,	130.24	242

The Mountain Gauges.

	Feet above the sea.	In 13 months. 1847. 1848. 1st Dec. to 31st Dec. Inches.	Summer months. 1st May to 31st Oct. Inches.	Winter months. Dec. 1847 to April 1848, and Nov. to Dec. 1848. Inches.
21. Scawfell Pike,	3166	*64.73 From 1st May.	49.46	
22. Great Gable,	2928	91.32	46.81	44.51
23. Sprirkling Tarn,	1990	148.59	70.95	77.64
24. Stye Head,	1290	138.72	60.35	78.37
25. Brunt Rigg,	500	109.19	43.18	66.01
14. Valley to the West Wartdale,		127.47	50.16	77.81
13. Do. S.E. Eskdale,		95.71	37.69	58.02
26. Seatoller Valley, Common, Scathwaite, Borrowdale,	1334	139.48	57.97	81.51
29. Seatoller Valley, Common, Scathwaite, Borrowdale,	1334	177.55	68.96	108.59

It is remarked by Mr Miller, that from the table for the summer months, it appears that, between the 1st May and the 31st October, the gauge at 1290 feet has received 20½ per cent more rain than the valley; at 1334 feet, 15½ per cent more; at 1900 feet, 41½ per cent more; at 2928 feet, 6 per cent less; and at 3166 feet, 1 per cent less than the valley.

In the winter months the gauge at 1290 feet has collected 0.5 per cent more; at 1344 feet, 5½ per cent more; at 1900 feet, 1 per cent more; and at 2928 feet, 42½ per cent less than the adjacent valley.

The following is the rain-fall for the year 1844, ascertained from gauges put up by a Manchester society on various parts of the hills in the vicinity of Blackstone Edge; but it ought to be remarked that the rain-fall in this district during the year 1844 was from 20 to 25 per cent below the average: —

	Inches.
Slattocks or Laneside, near Middleton, about 450 feet above the sea,	28.8
Moss Loch, near Rochdale, about three miles from the foot of Blackstone Edge, about 500 feet above the sea,	30.3
Whiteholm reservoir, summit of Blackstone Edge, probably 1200 feet above the sea, (from the 1st of January to the 20th October only,)	31.6
Toll-bar, Blackstone Edge, easterly side of summit, 900 to 1000 feet above the sea,	34.2
Blackhouse, about a mile beyond the toll-bar, and on higher ground,	35.9
Sowerby Bridge, in the vale of the Calder, (Yorkshire,) 300 feet above the sea,	23.8

On the Peak Forest Canal.

Marple, 531 feet above the level of the sea,	29.40
Combe's reservoir, 850 feet above the level of the sea,	42.70

On elevated ridges between Bolton-le-Moors and Yorkshire, the fall has been found to vary from 48 to 60 inches per annum.

In the Mourne mountains, county Down, Ireland, the rain-fall was found at

Lough Island, Reavy, to be	72¾ inches per annum.
Spelga,	74 „

Were rain-gauges erected on elevated parts of Dartmoor, the Isle

* The fall of rain on Scawfell during the winter of 1847-1848 was lost, in consequence of injury sustained by the receiver from the frost.

of Man, the west and south-west of Ireland, a like heavy annual rain-fall would be found.

It is found that a remarkable discrepancy takes place between the amount of rain-water collected respectively at the surface of the ground, at the top of a house, and the top of a high church tower or steeple. This phenomenon has never been clearly accounted for; but, from all the circumstances connected with the case, no other inference can be drawn but that the cause of the lower gauges always receiving the greatest amount of water is due to the more saturated condition of the atmosphere near the earth. It was at first thought that this phenomenon was due to the fact that less rain fell in the higher regions of the atmosphere than the lower; but the reverse appears to be the case, not only from the preceding tables of mountain rain-gauges, but also from other observations. It will be a pretty safe rule to observe that the annual fall of rain increases in the British islands as we ascend to the height of 2000 feet, after which it decreases; but neither the increase nor decrease appears to have any direct ratio.

The effect of winds in producing rain, according to a series of observations made by Luke Howard extending from 1807 to 1816 inclusive, was found to be as follows:—

N.E.	S.E.	S.W.	N.W.	Various.	Rain.
74	54	105	100	32	25.18 inches.

Whilst it frequently rains in winter during east or north winds, those winds are almost always dry in summer. If, for example, during the winter season, the west winds have prevailed, with a very clear atmosphere, and an east or north-east wind suddenly arise, the sky becomes cloudy in a short time, one part of the vapour of water brought up by the south or west winds is precipitated in the form of rain or snow, and thick fogs occupy the lower regions of the atmosphere. In this state of things the barometer is often at fair. But if the east wind continues to blow, the sky becomes serene, although the air remains moist. If the converse takes place—that is, if the sky is clouded, the wind being in the east, and it suddenly passes to the south, the sky becomes clear, because the warm air from the south, by increasing the tension of the aqueous vapour in the atmosphere, dissipates it, and the atmosphere becomes comparatively dry, as the warm south wind at that season of the year is far from being saturated with aqueous particles.

Rain brought by north-east winds have a different character from those brought by the south-west. When the north-east wind suddenly begins to blow, the temperature becomes lowered, large drops of rain fall in abundance for several moments, the sky then again becomes serene. With south-west winds the rain is fine *drizzling*, and continues usually a comparatively long period. Rains, in the British climate, thus principally arise in consequence

of the cooling and precipitation of vapours brought by the south-west winds.

PROPORTIONAL QUANTITY OF RAIN IN THE INTERIOR AND WEST OF ENGLAND IN THE DIFFERENT SEASONS.

	West of England.	Interior of England.
Winter, ...	26.4	23.0
Spring, ...	19.7	20.5
Summer, ...	23.0	26.1
Autumn, ...	30.9	30.4
	100.0	100.0

These variations are due to two causes. In the latitude of the British Isles the air is hotter over the Atlantic during the winter than above the earth. When the westerly or southerly winds, loaded with vapour, begin to blow, the latter is precipitated when it becomes intermixed with the colder air over the land. To this has to be added the fact, that clouds lie much lower in winter than during summer, and are stopped by less elevated ranges of mountains. This is well shown by "the mountain gauges" observed by Mr Miller, from which it appears that whilst at 1900 feet elevation, one per cent *more* rain was collected in winter than in the valley—at 2928 feet, 42½ per cent *less* was collected.

Popular modes of predicating the future prospects of the weather.—The ordinary mode of judging whether rain is near or not, is by the barometer. This, however, unconnected with other observations, is a very fallible guide during changeable weather, the period when assistance is most needed.

Any *sudden* change in the height of the barometer indicates an approaching variation of the weather, but probably of only short continuance; a gradual alteration also indicates a change, but of longer duration. A very rapid depression to an extremely low point is generally followed by a severe tempest. The rising of the mercury usually indicates fair, as its descent foretells rainy weather. If the barometer is high in winter, frost may be expected; if it falls, a thaw is likely to take place. If the fall is rapid in hot weather, it forebodes thunder. In this country it generally rises with an east and falls with a west wind. The barometer oscillates most in variable winds, and about the equinoxes. It has daily periodical tides.

If the sky is cloudy, with a low barometer, showers may be anticipated; if overcast, and the mercury high, no rain need be anticipated, unless it be a thunder-shower. In the oscillations of this instrument, regard must always be paid to the direction, temperature, and humidity of the prevailing wind. If the sun is setting in a thick cloud, and the eastern horizon red, or rising red with blackish streaks over the sky, dim, or in a musky cloud, rain may be anticipated. If rising or setting pale, with dark beams or red streaks, or if setting red with an iris, or setting in so white a light that his disc can scarcely be defined, or rising with a red

northern sky, wind will probably follow. If setting clear in a red sky, or rising clear with an iris which gradually disappears as he ascends, the clouds at the same time gradually disappearing in the direction of the west, fair weather is indicated.

By the moon.—If the wind is south, and an iris surrounds its disc, probably the next day will be wet; if mock moons are seen, a tempest is near. A lunar halo indicates unsettled weather. If the disc appears much enlarged, or of an unusually red colour, or the horns sharp and blackish, wind may be expected; if clear, bright, and the spots distinctly seen, fair weather is indicated.

By twilight.—If the twilight is unusually protracted, though the atmosphere seems very clear, the higher regions are charged with moisture, and its precipitation may be anticipated.

By the rainbow.—If the predominating hue is green, it denotes continued rain; if red, rain and wind.

If it rains before sunrise, it will probably cease before noon; if it continues until noon, it will probably continue all the day. Rains commencing about 11 o'clock A.M. to noon, if they do not disappear by 1 P.M., generally continue all the day. When very distant hills, or prominent objects—as distant spires and towers—start into distant view, with a clear outline and transparent atmosphere, rain may be expected, for the air is highly charged with invisible vapour of water.

Many other modes have been named, derived from the animal and vegetable kingdom, only one of which we will notice at present, as it is not much known.

Preceding or during wet weather, the back of the common frog will be invariably found of a dirty brown or black colour. Preceding or during fine weather, its back will as constantly be seen of a pretty bright gamboge yellow colour. Intermediate states of the weather will be indicated by intermediate colours on the frog's back. In variable weather, this adjunct to observations made with the barometer and the dew-point, will oftentimes be found very valuable—such as during a critical hay season; for when the frog's back, barometer, dew-point, &c., simultaneously indicate fair weather, their combination may be relied on as the certain forerunner of clear weather.

We purposely omit any detailed account of the various clouds which have received the name of *cirri*, *cumuli*, *nimbus* (rain-cloud,) &c., as to do so would occupy much space. The descriptions are to be found in almost all elementary works on meteorology; besides, the terms and description are not adapted to the present state of education, not only amongst farmers, but all other classes. The *cumulus* (thunder-cloud) and *nimbus* (rain-cloud) are pretty well known to all. To give a dissertation on the different modifications of clouds and their respective meteoric influences, with the cause that give rise to each, would form a tolerably long essay of itself.

The mean pressure of the atmosphere at the level of the sea at London equals 29.9 inches of mercury, and the range is found to be at the same place from 30.82 inches to 28.12 inches. This brief notice of an instrument so well known (the barometer) that it is not requisite to describe it more in detail, is only introduced for the purpose of adverting to the fact, that the mean height of the barometer descends as it is elevated above the level of the sea. The fair-weather point at London is not therefore the fair-weather point at Birmingham; for as we proceed above the level of the sea, the fair-weather point descends on the barometric scale. This, with other circumstances in connection with the dew-point, prevailing winds, &c., ought to be noted, as it will be found that few places are precisely similarly circumstanced. As a guide for persons desiring to make the necessary corrections for elevation, I insert the following table, showing the number of feet of altitude corresponding to depressions of the barometer:—

Depression.	Altitude in feet.	Depression.	Altitude in feet.
0.1 inch.	87	0.6 inch.	527
0.2 "	175	0.7 "	616
0.3 "	262	0.8 "	705
0.4 "	350	0.9 "	795
0.5 "	439	1.0 "	885

This table is so near accuracy, that it is frequently used for the purpose of ascertaining the height of mountains. The heights so ascertained are found to nearly correspond with those taken trigonometrically.

Effect of elevation on temperature and lateness of harvest, with the highest level for the growth of corn in different latitudes.—In treating on temperature, it has already been stated that the thermometer descends one degree on Fahrenheit's scale for every 300 feet of elevation. High mountains situated near the equator exhibit the entire vegetation of the globe. At their feet will be found growing all the plants indigenous to tropical climes. Midway will be seen the vegetation of temperate climates, gradually declining through the whole range of polar vegetation to the last cryptogam which grows on the margin of eternal snow. The higher we ascend, the more does the number of phanerogamous plants diminish in proportion to the cryptogams. It will also be found that, in proportion to the elevation, the number of annual and biennial plants diminish, whilst the perennials increase proportionably. In high regions, annual plants are almost entirely wanting,

as in such places the seeds of plants do not arrive every year at maturity; consequently, even if accidentally sown, the species disappear. This is not the case with perennial vegetables, which can remain without ripening their fruits, or even bearing flowers. Their stems resist the cold of winter; or, if they perish, new suckers in spring arise from their roots.

The highest mountains in the British islands are from 50 to 100 feet below the limit of perpetual snow, the summit of Ben-Nevis being always denuded of its winter covering during three to five weeks in the year.

1200 feet elevation may be taken as the utmost practicable limit for profitable cultivation in South Britain and Ireland, and from 1000 to 1100 feet in Scotland. From other causes than climate, it will be found that there are few spots within the compass of these islands on which cultivation can be carried to these extreme limits. These causes are—the precipitous character of hill-sides, which offer great obstruction to the use of the plough; projecting rocks and numerous large boulder-stones, which have the same effect; and deficiency, or barrenness of soil, with a number of minor circumstances, such as distance from the homestead, &c., which will for ever cause the greater portion of our elevated districts to be left in natural pasturage.

Few places throughout these islands could be selected on which tillage might be exercised advantageously at limits even much below 1200 feet above the level of the sea. At Dartmoor, the elevated down-lands of Sussex, Alston, (Cumberland,) and an upland district in Derbyshire, some extensive flat lands may be found, where it might possibly repay a farmer to extend cultivation to its extreme limits; but, generally, it will be found that cultivation can be rarely carried on to any extent above 800 or 900 feet elevation.

The fact already noticed respecting the vegetation on mountains situated at the Tropics, proves that vegetation is not limited in consequence of the rarefied air found at high elevations. Cold and infertility of soil are the main causes of the inferior vegetation of elevated districts. Infertility of soil is perhaps the principal one. The latter, by means of the portable manure that can now be so abundantly, and, comparatively speaking, cheaply procured, can in a great degree be remedied, provided a sufficient depth of working soil could be found—which, however, is seldom the case, except in patches plentifully intermixed with broken rocks and boulders. In consequence of the great amount of rain which falls on elevated districts, a considerable waste of the soluble mineral ingredients of plants is constantly going forward, which, being carried away by floods, serves to maintain the fertility of our plains, carse and warp lands. That this gradual impoverishment of the soil found on our mountain sides and tops is one of the principal causes of their inferior vegetation, is in a great degree countenanced by what is seen in fields laid down with grass after having undergone a

scourging series of five or six corn crops, with only one manuring.* The grasses succeeding such a cropping will generally be found to consist of the less valuable species of the agrosti, whilst the bottom will be covered with the moss and lichen tribes. These apparently insignificant, but to the naturalist most beautiful series of plants, play a most important part in the vegetation of the earth, on the rocks, and their barren soils of our mountains, where the valuable plants cultivated by man would perish. These cryptogams, by virtue of their natural inherent power, will be found clinging and extracting their inorganic food, when a higher order of plants would be unable to do so. In this manner these commonly despised orders of vegetables become the purveyors of food for others of a higher class, in consequence of the gradual disintegration which they cause of the rocks and stones which contain their inorganic constituents, but which, prior to the absorption and disruption caused by their roots, existed in an insoluble, and consequently unavailable form. The mixture of mineral and vegetable matter thus formed, and carried down to the plains by the action of rain, forms our most valuable soils. When pastures or cultivated soils are found covered with moss and lichens, two things may be inferred;—firstly, that the soil has been impoverished by injudicious cropping; and secondly, that the atmosphere is moist. Generally speaking, however, the cause first assigned is the reason of moss appearing; for it must be a humid climate indeed from which moss will not disappear after giving the field a good top-dressing with manure. In the instances of growing on cultivated land and pastures, the cause may in most cases be attributed to exhaustion of the active inorganic constituents of plants, rather than to humidity; in which cases the lichen and musci tribes step in and assist in converting the dormant inorganic substances into an active or soluble form, and thus act as the pioneers of a higher vegetation. In the vegetable and animal world there appears a series of steps from the lowest or least complex state of organic existence to their highest types—the welfare of the latter being in a greater or less degree dependent on the development of the former.

Harvesting on elevated situations is not retarded so much on account of deficient heat during summer, as to other causes;—first, the difficulty of getting the land tilled and the seed sown early in spring—the consequence of which is, that the time of reaching maturity is driven off until late in autumn, at which season the temperature on elevated places begins to rapidly diminish, and much rain falls. Vegetation being very slow at the commencement of spring, and the severity and rains of winter being adverse to autumnal sowing, it follows that no grain should be sown on

* Plenty of such cases may be found in Wales, the west of Ireland, and other mountainous districts of that country; also in Scotland.

elevated districts but such as mature rapidly—black and white Poland oats, and hardy species of barley, such as the Siberian, being best adapted for this purpose. Spring rye takes too long a period of maturing, and the autumnal sorts are liable to be injured in winter. Wheat can rarely be sown advantageously at a higher elevation than 800 feet. We know an instance where flax was grown at 900 feet above the level of the sea, in the Lake district, when the annual rain-fall is 84 inches.

Flax, to be pulled for the white, as it is termed—that is, soon after it has flowered, but not formed the seed—can be grown more advantageously on many high situations than the cereal crops. It could be sown in April, and gathered in the month of August—that is, during *the only* growing season in mountain districts. On the elevated downs of the south of England, barley forms the most appropriate crop; whilst on the more humid elevations of the north and west of England, Ireland and Scotland, oats is the most appropriate crop. In Cumberland and Westmoreland, oats may often be seen growing as high as 1100 feet. Crops so grown are, however, generally characterised by a shortness of straw, such as is frequently observed during cold summers; and if the crop is not fully ripened by the end of September, the grain proves very inferior. I shall have again to revert to the effects of mountain climates in the course of the two succeeding sections. It may, however, be here observed, that what may be termed the comparative shortness of the summer season on elevated districts is not so prejudicial to the growth of turnips, rape, &c., as the corn crops; and there are many spots throughout these islands that could be made advantageously productive by growing alternate crops of turnips or rape with oats and grass, by which a greater amount of provision could be made of winter food for stock, whether that consisted of horned cattle or sheep—by which means a considerable part of the lean stock now thrown on the market during the autumnal fairs, and thus depressing prices at that season of the year, might be retained until spring, when higher prices can be obtained. By this means the prices of lean stock would be more equalised over the year, to the advantage of both buyer and seller. Such a system would also give the mountain grazier an opportunity of rearing stock during the autumn and winter months, to replace such as are drafted off in the spring.

Effect of climate on the growth of grass, the different kinds of corn, and roots, fruit, and timber trees.—Our best grasses, whether as respects grazing or forage, luxuriate in a warm moist climate and soil, the latter sufficiently pervious to prevent the accumulation of stagnant water. These grasses are the *Dactylis glomerata* (cock's-foot,) *Phleum pratense major* (the great meadow cat's-tail or Timothy,) *Festuca elatior* (tall fescue,) *Poa fertilis* (fertile meadow-grass,) *Alopecurus pratensis* (meadow-foxtail,) *Holcus lanatus* (woolly soft grass, Yorkshire fog or white grass,) the

bromes and oat grasses, the *Cynosurus cristatus*, (crested dog's-tail, &c.) Of these the last-named grows also pretty well on light and down lands. A moist climate with a moderate temperature appears indispensible to the luxuriant growth of these grasses. They are therefore found to grow best on the western border of the island—on the downs and light lands of the south-east of England, Bedford, Hertford, &c. The grass-land is better adapted to grow pasture-grasses for sheep rather than meadow-land. Tares and other leguminous crops also grow better than the grasses first-named on the dry soils just named. For forage, clover is therefore better adapted for cultivation in the south-east of England rather than grass seeds. This is deserving of attention, as it is known that wheat succeeds better after mown than grazed clover, in consequence of the greater development of root in the case of mown clover over that which has been grazed, which in the course of their decay yield a greater amount of food for the succeeding wheat plant. The character of the soil has, however, much to do with the growth of grasses, even under similar circumstances with respect to climate. Thus tolerably stiff clay soils, in a dry climate, yield heavier crops of hay, and more herbage, than chalk downs or sand, though both may be so situated as to be equally circumstanced with respect to general humidity and temperature. On the other hand, too great an amount of rain lessens the value of grazing grounds, in consequence of the grasses containing so much water. Thus the richest grazing grounds in England, or in the world, are found between Skigness and Wainfleet, in Lincolnshire; next to which are the celebrated Aylesbury and Endersleigh pastures, all of which have only a moderate annual rain-fall. The growth of grasses* and the Brassica tribe have a greater reference to the mean temperature than that of a particular season, such as summer. With grain, or, as they are termed, the cereal grasses, the converse of this is the case, as they are little affected by the most rigorous winter; but a cold summer is ever found detrimental to the development of the grain. A great part of the grasses which compose our most luxurious meadows and pastures would be destroyed by a Canadian, and annihilated by a Siberian, winter; yet these severe winters do not affect the growth of wheat. A remarkable instance of the slight effect which severe winter colds have on some plants is instanced by Humboldt, in the case of Astrachan, situate in 46° 21′ north latitude, with a mean annual temperature of 48°. Summer, however, brings sometimes 70° 2′, and the winter 13° to 22°. Yet, with these extremes, Humboldt observes that in no place did he ever see growing such luxuriant bunches of grapes.

The north part of Scotland,† where wheat is sometimes culti-

* Understood here only with regard to forage-grasses, as distinguished from the cereal grasses, such as wheat, oats, &c.

† Sutherland and Inverness.

vated, situate in north latitude 58°, possesses a mean annual temperature of 46°, winter 35°, summer 57°. Yet in West Russia, latitude 60°, the mean temperature of the year is 38°, winter 16°, summer 61°. In consequence of this summer heat, West Russia is a wheat and flax producing country. For the production of wheat the mean summer temperature of any place ought not to be below 58°; and if in a humid climate, the disadvantage ought to be made up by a greater temperature or higher cultivation. In the more northern districts of Scotland, the deficiency in the mean summer temperature is in some degree compensated by the greater intensity of heat when the sun is nearest the zenith for that latitude, and by the increased length of the day; from which causes our northern and southern districts possess climates of greater similarity than their relative distances from the equator would appear to justify. Quick-growing cereals are the sorts that should be grown in northern latitudes, so as to ripen when the temperature is the highest and the days the longest. In Canada the transition from winter to spring is almost instantaneous. After a few days' thaw, vegetation is resumed, the country becomes enveloped in a mist for about three weeks; during which, and for a few weeks after this mist disappears, the stems of the grain crops shoot out in a most extraordinary manner. The period analagous to our spring is therefore of short continuance, which is quickly followed by summer, to be succeeded by a short autumn. As little rain falls during the summer, the grain quickly ripens, and is secured before the commencement of winter, which in Canada sets in very suddenly. Similarly circumstanced is a great portion of the wheat-growing countries in Eastern Europe; and the suggestion may here be thrown out, whether it would not well repay the farmers of Great Britain to annually procure their seed corn from East Europe. A practice has for the last few years obtained in Northumberland, of sowing spring wheat, the seed of course of British growth. The wheat is sown in spring, after turnips, soiled with sheep. The practice is found to answer, although the stiff soil and humid climate of Northumberland are far from being the best adapted for such an experiment. During a dropping autumn, harvesting in such cases is found precarious. Now, if by procuring seed from the east of Europe the harvest could be made earlier by three weeks, or even a fortnight, the evils of a delayed or protracted harvest might perhaps be surmounted even in wet years. The suggestion is founded on the well-known fact, that plants for for some time retain the same habits to which they were accustomed in the place of their ordinary growth, until acclimated to the region into which they are transferred.

The effect of diminished temperature upon root-crops, rape, and other members of the Brassica tribe, is principally seen in their diminished growth. Swedes and rape can be grown from 1000 to 1200 feet above the level of the sea. On Moel Famma,

Denbighshire, some were grown last year 1500 feet above the level of the sea. On elevated places, however, the size is but small as compared with those grown in the vales. It is, however, quite possible to secure a crop of ten tons of Swedes at elevations varying from 1000 to 1200 feet, other circumstances being favourable. The dry climate of the south-east of England is unfavourable to the development of root or green crops, as they are sometimes termed. Barley, pease, vetches, sainfoin, and permanent pasturage for the breed of sheep belonging to the district, is the husbandry that should be pursued in the dry chalk and sandy soils of this district. As a substitute for turnips, beet should be cultivated, as the deficiency in weight will be made up by the excellence of the quality: the yellow globe variety ought to be preferred on lands in high tilth. Wheat of good quality is also here grown.

To sum up, a moderately dry climate, like the south-east and east of England, and the south-east of Scotland, with a mean summer temperature of 59° to 60°, is adapted to the growth of wheat, barley, and leguminous plants; the moist climate of the west of England, North and South Wales, Lancashire, Ireland, and the south-west coast of Scotland, is calculated to produce root-crops, grass, oats, and, with a high state of tillage, wheat also. The north of Scotland is adapted to the growth of oats and grazing.

Inclement winters are known to be prejudicial to fruit-trees. The choicer descriptions are, therefore, most commonly grown in Kent, where a mild climate and congenial soil are found in conjunction.

The mild climate of Devon sometimes occasions the fruit-trees to shoot out and blossom prematurely. If, as sometimes happens, a mild and early spring is succeeded in April and May by cuttingly cold north-east and east winds, a blight ensues. In consequence of the severer winter's cold in Hereford and Worcester, as compared with Devon, the fruit-trees in these counties are later in blossoming, and therefore occasionally escape the destructive effects of the south-east winds alluded to. More frequently, however, the easterly winds of spring are equally destructive to both districts.

Of trees, the chesnut matures its fruit only within a very narrow strip across the south of England. The oak and ash are found to thrive from the south of England to the centre of Scotland, their growth being more regulated by the character of the soil (within these limits) than the effect of temperature. Amongst the Welsh mountains, the oak does not appear to flourish above 1000 feet, in consequence of the extreme moistness of the climate encouraging the growth of lichens and mosses. I have seen, in some of the glens in North Wales, young oak woods, at such elevations, hung with festoons of lichens. In the British Isles, the middle of

England, and the vales of North Wales, appear to be the country peculiarly adapted to the growth of oak timber. The oak wood behind Trentham, Staffordshire, the seat of the Duke of Sutherland, is a noble relic of the magnificent forest which covered a great part of the counties of Stafford, Warwick, Leicester, Nottingham, and the West Riding of Yorkshire, a few centuries ago, under the titles of Charnwood, Needwood, and Sherwood Forests. The birch is the hardiest tree we have in these islands, and will thrive amongst barren rocks and soils, on which nothing else will grow but the Scotch fir.

Hornbeam, hazel, and oak coppices can be profitably grown on the sides of hills, such as are found in many parts of North and South Wales, Cumberland, Westmoreland, and Devonshire. Larch grows exceedingly well on the soft silurian rocks, or any open soil other than sandstone, silicious grauwacke, and limestone rocks. On these the Scotch fir should be grown. If larch or other timber trees are seen growing on limestone rocks, it will be in consequence of at least a moderate thickness of superficial soil being present. On bogs, in elevated districts, the Scotch fir ought to be planted.

The situations in Great Britain and Ireland proved by experience to be best suited to each kind of agricultural produce and stock.— The mild climate, during winter, of the west of England and Ireland, is indicated by the manner in which the arbutus and similar plants grow in those districts. South Wales, along the borders of the British Channel, has a climate somewhat similar. In these districts, frost scarcely ever penetrates the earth so as to injure plants, whilst in similar latitudes in eastern Europe, the ground will be found frozen to the depth of eighteen inches or more. Places possessing winters of such a mild character are peculiarly well adapted for growing early spring food, such as winter tares and rye-grass; also for market produce, such as early potatoes, cabbage, &c. The sale for such is, however, limited, and therefore cannot be taken into consideration as articles of general husbandry. The humidity of the summer is unfavourable to the growth of wheat, beans, pease, and barley; but favourable to rape, turnips, grass, and oats. In consequence of the low acreable value of oats, as compared with wheat, the latter will always be preferred as a crop by the farmer, though he is aware that the climate is not the best calculated for its production. In some places, however, the humidity of the climate has been found so unfavourable to the growth of wheat, that by common consent its culture has been abandoned. As an example may be instanced the fine alluvial soils on the banks of the Mawdach, reaching from Dolgelly to Barmouth, in Merionethshire, North Wales. Wheat has been found to ripen only occasionally, and that merely during dry summers. Here, even oats, in wet years, ripen with difficulty, producing only a long slender grain, with much straw. In moderately dry years, some of the finest oats in the kingdom are

grown on these alluvial soils. One of the principal features of humid climates is, that they will produce moderate crops on soils which, in dry climates, would scarcely produce anything. That is attributable to the solvent properties of the rain-water and carbonic acid, which penetrate the soil in greater abundance in humid than dry climates. Thus, in taking into consideration the effects of the climate of any particular district on general agriculture, another element of calculation must also be kept in view—viz. the nature of the soil. For example, the fine open loams converted into marls by continued liming, which are found covering such extensive districts throughout Ireland, and superposed on the carboniferous or mountain limestone, compose some of the finest corn-growing districts within the British Isles, notwithstanding the general humid character of the climate. The open nature of the soils, and the ruptured character of the subjacent limestone rock, permits all superfluous water to pass freely through, thus giving to these soils a comparatively dry climate, in consequence of little more water passing away by evaporation than is retained hygroscopically by the soil. Had these soils been of a stiff retentive nature, like the strong clays of Leicestershire and Cheshire, the soils of Ireland covering the mountain limestone would have been less adapted for the growth of grain, and would have been more valuable in permanent pasture. The rationale is this—with a porous soil the water freely passes off, thus causing little diminution of temperature by evaporation. In the case of stiff retentive clays, a great amount of water is held both hygroscopically and mechanically, which is prevented from flowing to its natural outlets—brooks and rivers. A large portion of the calorific rays of the sun is, therefore, absorbed by the water in the soil, and eventually passes into the atmosphere in the form of vapours. The evaporation occasioned by the absorption of heat * causes the climate on clay soils to be cold and humid, which, added to the additional cost of cultivating clay soils, renders them better calculated for pasture than the cultivation of corn.

If we pass from the limestone to the old red sandstone of England and Ireland, we shall find, in the first country, the rich lands of Hereford, where some of the finest orchards and oaks in England are to be seen; the soil, in consequence of its minute mechanical division and great depth, being retentive of moisture, and well calculated for arboriculture. Where the soil becomes thin and more open, from its deficient depth, comparative sterility is the consequence. Such a district is known under the name of "The Ryelands," having acquired that title centuries ago in consequence

* I have not given any formula for calculating the degrees of heat abstracted from vegetation by evaporation, as our scales of temperature give no idea of the relative amount, the figures for the degree of temperature becoming so enormously great when calculated by the number of cubic feet of water evaporated from an acre of land.

of its non-adaption to the growth of any other grain than rye. This district has subsequently given a name to a small breed of sheep that has been found best adapted to its arid character. In Ireland, we find the deep alluvial soils of the old red sandstone covered with bogs, and the light lands of that formation well adapted for the four-course system of husbandry, the aridity of the soil being compensated by the humidity of the climate.

In judging of climate in its effects on agriculture, a very inadequate conception of its action would be formed by merely referring to the relative quantity of rain, heat, &c., which may obtain at any particular place or places, the agricultural characteristics of a country often varying as much from the nature of the soil as from difference of climate. In prior sections I have sometimes adverted to the nature of crops best adapted to certain localities, which, with the following summary, may be found sufficient. On the light and down lands of the south and south-east of England, barley, pease, vetches, sainfoin, and clover, alternating with pasture, to be grazed by the native sheep of this district, will generally be found most productive, taking a crop of wheat occasionally. The climate of this district is well adapted to the growth of wheat, but the soil is frequently unfavourable. Gault lands and lias clays are best under permanent pasture; in the eastern counties, on stiff soils, beans, wheat, and clover, alternating with pasture, will be found most productive: where the soil is not too stiff, these may be intermixed with turnips and beetroot, in which case barley and clover will succeed them, to be followed by wheat. Cattle are found more profitable in grazing *strong* clay lands, in the eastern counties, than sheep: this is a rule of general application throughout the three kingdoms. In Norfolk, Lincoln, and the fen counties, the four-course husbandry is adopted—in the fens, however, sowing rape in place of turnips. Rape and carrots are also better calculated for growth in peat soils than turnips; carrots also do well in sandy soils. The heavy clay lands of the midland counties are best under pasture; this remark also applies to the ochreous yellow clay on the magnesian limestone of Northampton, lias, kimmeridge, and Oxford clays. The clays of Northampton just noticed are, unfortunately, in general under tillage, and are of that character that a sward is not replaced with facility, though easily destroyed. The heavy clay lands on the magnesian limestone and lias of Yorkshire, principally developed in the Vale of Cleveland, is also better adapted for pasturage than arable culture. Those who attended the exhibition at York must be sensible of the difficulty which a farmer would have to surmount in tilling land during a wet year, such as that on which the show-yard was held. A large portion of the clays found on the new red sandstone, and the saliferous marls of Cheshire, Gloucester, and Worcester, are good pasture grounds. When in cultivation, the soils just named are well calculated to produce beans, wheat, tares,

and clover. An important circumstance was communicated to the writer lately, viz., that last year one of the finest dairies of cheese, which obtained the highest price for the London market, was obtained from cows that were house-fed during the summer with vetches and clover. This has been considered a most remarkable circumstance, as *grazed* clover and vetches, given to loose cattle, has ever been remarkable for producing bad cheese. The cause most probably is as follows: Clover and vetches, in common with the whole tribe of legumes, contain a larger proportionate amount of caseous (cheesy) matter than grasses, the latter containing a greater amount of saccharine and oily substances. The best cheese commercially is not that which contains the greatest amount of cheesy, but that which contains most of the butryaceous substance (butter.) When clover or other legumes are consumed in the open air, a great part of the saccharine and butryaceous substances are consumed in sustaining the power which the animal expends in moving about; consequently the milk contains less butter and more cheese, producing what is called a poor cheese. When house-fed, a much less expenditure of animal heat and power takes place: the substances of the food of easiest assimilation, such as saccharine and fatty matters, are absorbed by the animal system, whilst the caseous substances are in a great measure voided in the fœces. It has been ascertained that, with different animals fed on the same food, one grazing and the other stall-fed, the milk from the grazing animal contains the most cheesy matter.* The subject is important, in connection with the possibility of rendering our stiff clays more productive, by turning a portion of every clay farm into arable cultivation. The opinion of the writer is, that there are few farms on which it would not be more profitable to have some part in cultivation, rather than leaving all under pasture. The stiffer the soil, the less could prudently be brought under aration. The slate and silurian mountains and hills are adapted to all kinds of husbandry—mixed grazing of sheep and cattle, turnips, barley, oats, and wheat, according to circumstances. The high mountains of the old red sandstone, so largely developed in the vicinity of Brecknock, Hereford, &c., are well calculated for rearing young cattle of the Hereford breed, and sheep. The above remarks are applicable to similar soils in Ireland and Scotland.

Of stock, the Devons appear well adapted to their own district, but do not appear to have any peculiar characteristics by which they are entitled to displace other breeds in different localities. The Hereford (which, by-the-by, appears largely to partake of the qualities of some of the best Welsh native breeds) is particularly well calculated for the old red sandstone district, and will feed in

* This has been attributed to the fact that, during the motion of the animal, the fibrine of the blood is converted into casein.

the open air during winter, where the short-horns would deteriorate. This quality is well known to the graziers of the midland counties.

The old Long-horn is an animal that stands the effects of great humidity beyond all other breeds of South Britain: it is best suited for grazing on cold retentive clays, yielding a great abundance of coarse herbage. It has, however, of late gone much out of fashion, and is only now to be found in Ireland, and occasionally in Wales. In Ireland, the breed is also much going out, the greater part of the grazing cattle now reared in that country being a cross between the long and short horns—a cross that appears well adapted for the present state of agriculture in that country. In Scotland, the long-horn is replaced by the Galloway, and black Highland cattle known as Scots. North Wales also possesses a fine hardy race of black cattle, little affected by a wet climate.

Of sheep, the short-woolled or Southdown varieties are well fitted for the dry soils and climate of the south of England: on the more humid districts the long open-woolled varieties thrive best. Whether it respects cattle or sheep, it will invariably be found that heavy kinds of each description are connected with strong heavy grazing lands producing much herbage. In Scotland, the finest black cattle are found in Moray and Angus; in England, the long-horns on the midland clay district; in Ireland, the same; in Wales also a similar rule applies. In like manner with sheep, small short-woolled varieties are found on arid soils and dry climates—large varieties where the soil is heavy, climate humid, and herbage succulent. The Leicester sheep and short-horned cattle appear best calculated for mixed husbandry—the latter for stall-feeding rather than open grazing.

How far it is desirable to adopt the regular four-course arable system on the western sides of England and Ireland, the same being naturally fitted for the spontaneous growth of grass.—This question is practically illustrated by what is done within a considerable district of Lancashire, stretching from the Mersey to the Ribble, and gradually extending through the Fylde and Low Furness districts in this county; also in Cumberland, and parts of Westmoreland, such as the limestone district south of Kendal, and the limestone and new red sandstone bordering the northern part of the latter county. Even amongst the mountains, where the annual rain-fall reaches from 60 to 100 inches, turnips, alternating with oats, grass, or clover, is frequently to be found. In making these observations, it ought to be observed that alternate husbandry, rather than the strict four-course system, is here recommended—oats taking the place of barley. It has already been remarked that the moist climate of the west of England and Ireland is ill adapted to the growth of wheat. On the other hand, perhaps there is no climate in the world so well calculated to grow fine crops of

turnips, and the brassica tribe generally, than the district now under consideration.

In Lancashire, between the Mersey and the Ribble, the heaviest crops of turnips, potatoes, carrots, and wheat, are obtained of any district in England. On the south-eastern borders of Cornwall, and the western side of Devon, very heavy crops of the same articles are obtained; but the wheat crop is not so heavy—the heavier wheat crops of Lancashire being owing to the heavy manuring with town manure, obtained from Liverpool, *viâ* canal, at the low toll of one farthing per ton. In dropping years the effects of a moist climate is, however, here very visible, both in lateness of harvest, and light grain, as compared with dry seasons. In fine years, 50 bushels of wheat—70 lb.* to the bushel—is anything but an uncommon crop after carrots, potatoes, or swedes; all which crops are drawn, and sold at Liverpool or the other large towns. The great problem of husbandry in the western districts of these islands is, What is the best mode of converting green produce into money? Feeding-stock, in some form or other, is indispensable; but the question is, Can green crops be grown continuously with advantage, without alternating to any great extent with grain? or will it be better to have green crops alternating with grain (oats) —both to be consumed by stock? The instance previously given of a fine dairy of cheese being obtained from cows stall-fed with clover and tares, is a pretty indisputable proof that dairy produce may be obtained from stall-fed cattle to a much larger extent than is at present suspected. It may be held as an axiom, that the produce of the land returns the highest money-value to the farmer when disposed of in the following manner:—viz., milk, (at a standard value of 1½d. per quart), butter, cheese, meat. Growing wheat in the moist climate of the west of England, and Ireland, is not advisable. The instance of what takes place in part of Lancashire cannot be here taken as a rule: this exception is owing to the excessive manuring which is practised in Lancashire. Seeing the order in which produce remunerates the farmer, it does appear to the writer that the alternate system of husbandry is peculiarly well adapted to the moist climate of the western district of England, and Ireland. Whether the green produce could be more profitably used by consuming an alternate crop of oats is a question on which there is not sufficient evidence to decide: the writer's opinion is that it would. In consequence of the continued demand for Ireland, maize or Indian corn has not been obtainable at a sufficiently reduced price to justify extensive experiments with it, as an addendum to green food. On the light lands of Devon, Furness in Lancashire, and Cumberland, the four-course system is practised beneficially: it would also answer well on the porous

* The local conventional weight. Wheat, however, rarely weighs more than 63 or 64 lb. per bushel, though the plump appearance of the grain would lead a casual observer to suspect that it did. The plumpness is due to moisture.

soils of the old red sandstone in Wexford. Seeing that farmers, on the thin soil of Lincoln heath, find it advantageous to purchase large quantities of provender to be consumed by cattle along with green food, almost solely for the purpose of obtaining manure, it must be inferred that, if a similar practice was adopted with the farmers of the western coast of England and Ireland, it would be found equally advantageous—particularly when it is remembered that the climate of these places is peculiarly well adapted to the growth of green food in the form of turnips, rape, vetches, clover, or grass. Although the climate of these districts is naturally fitted for the spontaneous growth of grass, it does not therefore follow, that by that means *only* can the greatest profit be derived from the land. To obtain the largest pecuniary return in most climates, the growth of artificial green food, with its consumption under shelter, is indispensable; for it must be remembered that a large part of the food eaten by grazing cattle is used in the maintaining of animal heat, which is so rapidly evolved and consumed by evaporation during inclement weather. In consequence of this circumstance, green crops are much more profitably consumed under shelter in humid than in dry climates.

In drawing this essay to a conclusion, it may be remarked that the endeavour has been made to instruct the uninitiated in the general laws which regulate climate. Rather than by giving empirical rules drawn from limited local observations, it was deemed much better to do so than by giving partial illustrations only, and thus leaving the grand and universal laws which regulate climate unnoticed. Minds endowed with keen powers of perception and observation may, by persevering attention, reduce the prognostication of irregularities of climate apparently to certain rules. Characters of this description will, however, find their studies much facilitated when made aware that particular phenomena are the results of fixed laws. This knowledge will enable the observant to discriminate between indications which are certain, and others which may be illusory, notwithstanding any observed coincidences which may have been remarked.

The different sections into which this treatise is divided would separately form the subject of an important and tolerably long essay: many details have thus necessarily been curtailed, or wholly left out. It has, however, been attempted to give a synopsis of the great ruling laws, sufficiently distinct to enable the reader to comprehend them. The limited space allowed for an essay of this kind renders diffuseness inadmissable: for the sake of brevity, the opposite errors of abruptness and deficiency of details have possibly been fallen into.

We cannot more appropriately conclude than by quoting the notice of Sir John Herschel on the terrestrial effects of the sun's radiation:—

" The sun's rays are the ultimate source of almost every motion

which takes place on the surface of the earth. By its heat are produced all winds, and those disturbances in the electric equilibrium of the atmosphere, which give rise to the phenomena of lightning, and probably also to those of the terrestrial magnetism and the aurora. By their vivifying action, vegetables are enabled to draw support from inorganic matter, and become, in their turn, the support of animals, and of man, and the sources of these great deposits of dynamical efficiency which are laid up for human use in our coal strata. By them the waters of the sea are made to circulate in vapour through the air and irrigate the land, producing springs and rivers. By them are produced all disturbances of the chemical equilibrium of the elements of nature, which, by a series of compositions and decompositions, give rise to other products, and originate a transfer of materials. Even the slow degradation of the solid constituents of the surface, in which its chief geological changes consist, is almost entirely due, on the one hand, to the abrasion of wind and rain, and the alternation of heat and frost; on the other, to the continual beating of the sea waves agitated by winds, the result of solar radiation. Tidal action (itself partly due to the sun's agency) exercises here a comparatively slight influence. The effect of oceanic currents, (mainly originating in that influence,) though slight in abrasion, is powerful in diffusing and transporting the matter abraded; and, when we consider the immense transfer of matter so produced, the increase of pressure over large spaces in the bed of the ocean, and diminution over corresponding portions of the land, we are not at a loss to perceive how the elastic power of subterranean fires, thus repressed on the one hand and relieved on the other, may break forth in points when the resistance is hardly adequate to their retention, and thus bring the phenomena of volcanic activity under the general law of solar influence."

That such a wide range of phenomena should only be imperfectly sketched in an essay of this kind, is what could only be anticipated.

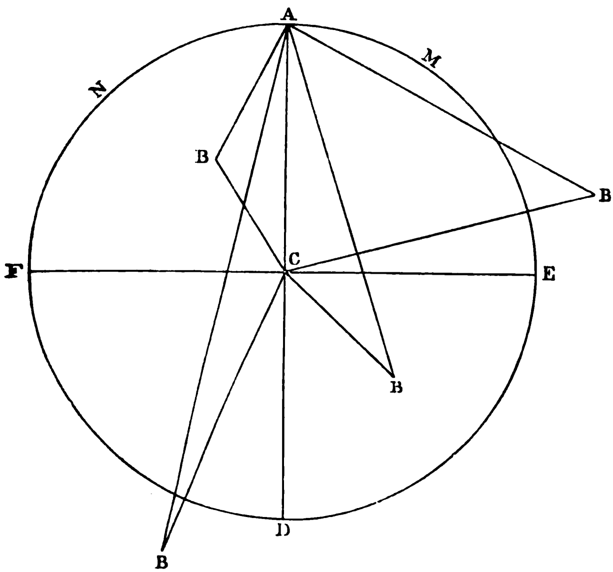
METROPOLITAN CATTLE-MARKET.

In every province of the kingdom complaints are loudly raised at the treatment of fat stock in the different markets. It is universally admitted that cruelty is not only practised openly, but that enormous losses are sustained—a state of affairs only pardonable because plodding habit cannot see a different course to follow. We shall endeavour to point out a different system; but, before doing so, it will be advisable to discuss, first, the present practice. As justice cannot be done to both subjects in one article, and as the metropolitan cattle-market is about to be removed, we shall take up the question of a Central Suburban Market, in the hopes of reconciling some of those who are apprehensive of ruinous

consequences in the change about to take place. In doing so, we shall enunciate the following simple proposition.

A straight line A B, drawn from any point A, in the circumference of a circle A E D F, to any point B, on any side of the diameter A D, or diameter produced without the circle, is less than the sum of the straight lines A C and C B, drawn from the centre C, to the two extremes A and B of the straight line A B. The truth of this proposition is obvious from the property of a straight line, viz.—"that it is the shortest distance between two points." But simple as this demonstration is, we deduce the following important conclusions from it, barring all that has been said to the contrary :—

Fig. 1.



1. That cattle would traverse the streets of the metropolis less from a market in its suburbs with a railway to it, than from one at its centre without a railway ; and that a railway to the centre would exceed that to the circumference by radius.

2. That this is true of any number of markets, and in whatever points of the circumference they may be placed.

3. That if more than the half of the number of the cattle shall come from one side of any diameter, as from A in F C E, then the market should be placed in the circumference on that side of the diameter—*i. e.*, in reference to Smithfield, that, as the majority of the beasts comes from the north, the market should be on the north side of the river.

4. That that point in the circumference of the circle should be taken, so that the number of cattle coming from one side, multiplied by the distance travelled over, would be equal to the number of cattle coming from the other side, multiplied by the distance travelled over.

5. That butchers, if equally scattered over the metropolis, would have farther to travel to a suburban market than a central one.

6. That farmers and consumers would be losers by a central market with or without a railway to it, but butchers gainers as to distance only ; consequently, that they should pay for this gain, and not the farmer or consumer.

7. That cattle should be sold in their lairs, and not removed therefrom until led to public slaughter-houses adjoining.

Such are the several propositions which we deduce relative to

the metropolitan cattle-market question, on each of which we shall now briefly offer a few practical observations.

The truth of the first and second will readily be perceived on glancing at the diagram. If, for instance, we suppose Smithfield situated at the centre C, first without a railway, and that B is any butcher's shop, or B B B B all the butchers' shops in the metropolis, then cattle coming from the point A would have to walk from it to C, and from C to B B B B, after being sold, before they could arrive at their final destinations, supposing they are driven directly to the slaughter-house. Now, as the sum of any two sides of a triangle is greater than the other side, it consequently follows that the distance thus travelled is greater than if they had travelled directly from A to B, for A C+C B, is greater than A B.

Again, if we suppose that a railway is brought to Smithfield from the circumference, as from A to C, then we arrive at the question of radiating the metropolis, so to speak, with railways to its centre, than which scarcely anything can be more absurd in practice. It may be said that one railway from the circumference would suffice, and that cattle could walk from the market to their final destination: surely, after the ox becomes the property of the butcher, he ought to have the liberty of doing with his own as he thinks best, without being curbed by any one.

We have here two propositions involved—*First*, If a fat ox arrives at any point D, he should be conveyed to the centre, *viâ* F A C. *Second*, That cattle should be travelled from the market.

Now, in the first of these propositions, we have two important concessions granted; for if we suppose F E to represent the river, and A its north side, the cattle coming from the south side ought to travel *viâ* D F A to C—consequently they would have farther to travel to a central market than a suburban one situated at A, by the distance A C, and that railway conveyance ought to supersede the drove. These two, we say, are important concessions in favour of a suburban market on the north side of the river—and that they are sound, being in harmony with science and practice, cannot be doubted; consequently, in the subsequent discussion, they must be borne in mind.

The second proposition—that cattle should be travelled from the market, is entirely at variance with the second concession, being its direct counterpart. But it may be argued—the ox is now the property of a metropolitan butcher, and therefore science must stoop to practice. Within the circle, practice is one thing, but without it, a different thing. Within the confines of the British capital, if we can believe a Smithfield banker, "fat oxen are locomotive animals: walking is as natural to them as eating." How long they may remain so it were difficult to say, in times so novel as the present. Probably, when Messrs Bell & Petit mature their locomotive balloons, and when they succeed in conveying cattle from one place to another as pigeons carry letters, then the fat ox may cease to

be a *locomotive engine!* Art will then triumph over the natural system; but not until then. Without the circle, again, practice, as we have said, is very different—for here the farmer often experiences the greatest difficulty in getting the fat ox to rise; let alone walk, and the fatter, the less locomotive it becomes; but when once it crosses the magic circle A F D E, the goads, dogs, and lassos of Smithfield soon put up the steam! *Hominis est errare.* Are not half the benefits now gained by railway conveyance lost by the treatment which cattle experience in the metropolis?

The impropriety of travelling fat stock, and the loss to the farmer, we shall have to notice under the sixth proposition; and, therefore, to avoid repetition, shall add no more in this place on the topic.

The third and fourth propositions have reference to the side of the river, and point, in the suburbs, on that side in which a cattle market should be placed — propositions the truth of which has been admitted under last head. The theory of two markets, however, may now be introduced as an objection. It has, for instance, been said, that if the farmers on the north side of the metropolis are to have a market in the northern suburbs, then the farmers of Kent, Surrey, and Sussex should have another market in the southern suburbs; but such an argument falls to the ground, for no other reason than that those counties do not grow a sufficiency of butcher-meat for their own consumption: so that, when farmers throw off their antiquated habits, and embrace the chemical and mechanical improvements of the times in which they live, they will have no surplus to spare. Nothing can possibly be more absurd than for Surrey to grow butcher-meat for Birmingham! and Warwickshire for Dover! That Kent, Sussex, and Surrey, however, require cattle markets, is a plain but different question; but that one market only should be erected for the accommodation of the *three*, and that that one should be situated in the southern suburbs of the metropolis, are conclusions which just say enough for those who deduce them from the facts of the case; for it would not bo more absurd to erect a cattle market for the consumption of Cornwall, Kerry, and Caithness at Holloway, than for Kent, Sussex, and Surrey on Clapham Common. At the best, a metropolitan market for Kent, Surrey, and Sussex, is but an argument for a suburban market, as to situation.

The fifth proposition enunciates, that butchers would have farther to travel to a suburban market than a central one. The truth of this proposition has never been called in question. No doubt, many adjoining the proposed new market would have less distance to travel than they have at present; but, generally speaking, this would not be the case. The question, therefore, resolves itself into one of difference of expense, and consequently falls under our next proposition.

Our sixth proposition involves the profits and losses of parties interested—from difference of distance and purity of atmosphere—

and is, therefore, not the least important one. The parties interested are—first, the farmer, with his representative the salesman; second, Smithfield bankers; and third, butchers and consumers. These interests we shall notice separately.

First, The interest of the farmer is of a three-fold character—management, expenses, and price of stock.

A fat ox is like a broached beer-barrel with a continual drain upon its contents, so that without a daily supply equal to the daily waste the result is obvious. During the flow, the effect produced by the discharge may not be appreciable to the eye, especially if there is not much difference between the ingress and egress, but it is no less certain on that account if the latter is the greatest.

Now, if a butcher or banker bought a barrel of beer knowing it to be broached and flowing, he would very naturally inquire of the brewer the quantity discharged in a given time — the length of time delivery would take, and so forth. The brewer might probably answer, "Never trouble yourself about the waste, for it is altogether imperceptible; and, moreover, it is not you who sustains any loss of that kind." To such an answer the obvious reply of the butcher would be,—that he only intended to purchase what he was to receive, or drink, and not what was to be spilt between the brewery and his beer-cellar. If he had no means of ascertaining this, he would just make a safe allowance, and, after having once ascertained what the barrel would measure out under such circumstances, would make his future calculations accordingly. The actual quantity which the barrel did contain when in the brewery he might remain ignorant of. It was a point upon which he was indifferent; for, so long as it measured out to him a certain quantity—the quantity he paid for—that was all he cared about. But propose the removal of the brewery to a greater distance, and you at once place the butcher into new embarrassments, out of which experience only can liberate him. After he has made an experiment he will move on in the old path again, unconscious of a better, or any difference, until some new proposition is enunciated. But whatever that proposition may be, the loss sustained by the broached beer-barrel must obviously fall upon the unfortunate brewer—for out of this dilemma he cannot by any possibility extricate himself but by stopping the flow.

Just so is it with the farmer and his fat ox or sheep, as it is with the brewer and his beer barrel, for he sustains the whole waste between the stall and slaughter-house; for butchers are practical men guided by experience, and only pay him for the weight which the scales indicate. If the butcher finds that an ox of such a size and handle weighs out so much under a certain routine of management, then he regulates his future purchases accordingly. With the waste between the stall and the slaughter-house he has nothing to do, any more than he had with the beer spilt between

the brewery and his own beer-cellar. If he puts anything in, he just expects to take as much out, in addition to the quantity purchased. So far is equitable; but for the ordinary waste he has made a safe calculation for himself. Propose, however, removing the market from the centre C to the circumference A, a greater distance from him, and you at once arouse his apprehensions. For the first time he perceives that the fat ox, after all, is not a *locomotive engine!* From A to C, and from C to B, it is so; but from A to B it is not, because we presume the angle A C B is greater than A B C. We know of no other reason, and shall conclude there is none; for the greater the angle A C B is, the greater is his loss. If you farther propose stopping the flow, as we do in the next proposition, and consequently propose making him pay for the whole beer which the barrel contains in the brewery, and thus save the unfortunate brewer from loss, you place the butcher in still greater embarrassments — embarrassments from which experience can alone set him free, and from which experience will soon set him free in the manner already noticed. The examples of Bristol and Liverpool, with many others, might be quoted in proof of this, where parties were as averse to a change as are those of the metropolis, but who have since got over their difficulties—*difficulties, not groundless prejudices, as many have prematurely argued, but facts requiring the aid of experiment to settle their values.*

Farmers are, like butchers, practical men only, generally speaking—few of them being familiar with the theory of daily waste upon a fat ox. Indeed, the theory has not yet been established upon a solid foundation—*experiment.* Indirect experiments, however, have been made, rendering the existence of a waste as evident and as ruinous as that upon a broached beer-barrel. They have, for instance, been made upon the human system, leaving the inference from analogy unquestionable. From observation, again, good judges of stock can perceive a loss between two periods of time, at no great distance from each other. Cattle, again, have been weighed and measured before sending them to exhibitions, and after their return. We ourselves invariably did so, and found a heavy loss, both from the Smithfield Club shows, Baker Street—from the annual shows of the Royal Agricultural Society—and from local shows of the district. Lastly, the food and excrements of animals have been analysed, and the difference worked up into the system recorded. We shall quote an example of this last kind, as being perhaps more satisfactory than the others, prefacing it with a general proposition, thus :—

Where no increase of weight is gained, the quantity of food consumed and daily worked up into the animal system is the equivalent of the daily waste sustained in the stall or feeding-box.

Now, according to the experiments of Dr Thomson, from parliamentary papers, it appears that the difference between the

elements of food consumed and dung voided by a small Ayrshire cow of about 70 stones live weight, amounts to 28½ lb. daily, as follows:—

Carbon,	6.87
Hydrogen,	0.93
Nitrogen,	0.28
Oxygen,	6.76
Ash,	0.38
Water,	13.50
Total,	28.72 lb.

This difference, however, does not exhibit the whole waste, for the drink which the cow consumed appears to have been excluded; for the quantity of water above does not correspond with the liquids ejected, leaving out of consideration insensible perspiration. From this experiment, however, coupled with those of Boussingault and others, the daily amount of solids and liquids given off from the system of an ox of ordinary size cannot be estimated at less than the double of what is stated above, or 56 lb., supposing it in the stall, and hence free from exercise and excitement. If subjected to both these exhausting causes, as invariably is the case in the system of Smithfield, or any of our other great cattle markets, then the waste might be double, or triple—according to the opinions of the most eminent of our chemists who have turned their attention to this branch of chemistry—supposing the animal supplied with food according to the demand of the system.

So much for theory. In practice, the farmer has unfortunately to contend with two antagonists of the most formidable character, besides the evils of a system to which attention will soon be drawn. First, his ox is in an artificial state, so to speak, in the stall; so that when it leaves it, and is subjected to exercise or excitement, however frivolous, it has no desire for solid or nourishing food. Encumbered with fat, nature, ever anxious to adapt herself to her own exigencies, feels inclined rather to throw off her burden than increase its weight. At the Smithfield Club exhibitions in Baker Street we have often pitied the silly observations of parties laughing and jeering at us and our servants slicing carrots, &c., and putting the bite into the animal's mouth, whose stomach and system generally was in danger from extremes of dieting so wide asunder—parties who ought to have known better, but who did not understand the difficulties with which we were contending. Had they seen the real brown stout flowing, they would doubtless have guessed at the propriety of turning the key of the tap of our beer-barrel; but, blind to this, our conduct was ridiculed as "*carrying the joke too far.*"

Second, From the effects of travelling, excitement, and fasting, the stomach and bowels invariably almost get deranged before the animal arrives in the metropolis, so that the food it consumes afterwards is not worked up into the system. Partial rumination

may take place, but, from the smallness of the quantity of food which enters the stomach for digestion, it does not excite its coats to the action of secretion, but is carried off through the intestines, a frothy mass of indigested matter; as any farmer or butcher may perceive who takes the trouble to examine it, either in Smithfield, or the streets leading to and from it, on a market-day—or, we might have said, any market in the kingdom.

Now, when we add to those two calamities the evils of the present practice, the position of the farmer will readily be perceived to be anything but a favourable one; for, in the first place, the ox is driven from the railway terminus to the lair, farther from the market in many cases than the terminus itself. It is next driven to the market, where it is wedged up and compelled to stand upon a hard and uneven sloping pavement or causeway, for from four to ten times the length of time necessary for sale—subjected to fasting and excitement—undergoing a species of half-hanging or strangulation, so to speak, from the running noose of the lasso around its neck. In referring to this patriarchal but barbarous instrument, the Hon. Mr Byng incurs the displeasure of the Smithfield banker already alluded to, who retaliates—" I do not well understand how they can be '*choked into compliance*,' since the difficulty is to get the noose over the head of the timid and obstinate animal. That once accomplished, the rest of the operation is easy." What is it which brings the more timid and obstinate into equal compliance with the less obstinate and less timid? we might ask. We shall suppose that the banker in question is well informed in his own office—as we believe he is—but he had better remain there; for his acquaintance with the management of fat stock is obviously out of date. When deer are put up to fatten, the keeper singles out his buck, when off dashes his hound at its victim, and soon brings it to bay, seizing its ear, and holding it fast. Now, there was certainly one stage before this—*the spear of Boadicea*, like that of the Amazon—and the next stage on this side is the lasso of Smithfield, beyond which the worthy banker appears astonished to think that any one would dream of a system more modern; for he asks in surprise, " How, then, do you propose having it effected?" A puzzler this! It was only in the reign of Charles II., in 1634, that the Act of the Irish Parliament was passed, forbidding, under fine and imprisonment, " A barbarous custom of ploughing, harrowing, drawing, and working with horses, mares, geldings, garrons, and colts, by the tail, whereby the breed of horses is much impaired in the kingdom," much to the astonishment of many a true-hearted Irishman, who could not account for such an unwarrantable attack upon his rights and privileges; and it is only in 1852 that Smithfield bankers are to be taught the first lesson in the management of fat stock! But to return to our narrative of the practice in Smithfield, where dogs, goads, cattle-vans, and carcass-trucks, are in full operation in

effecting a clearance. After the ox is sold, it is next driven from the market to the lair or grazing of the butcher—the latter not unfrequently several miles distant from his shop—and from thence, when required, to the slaughter-house.

Now, such being the facts of the case, it obviously follows that, however questionable the exact amount of waste may be, owing to the present imperfect state of science in this department, or rather absence of experiments to substantiate science, it must of necessity be enormous; for the system of the ox is subjected to all the exhausting causes in the highest degree.

Again, some parties, whom we have met on this important subject, argue as if they laboured under the erroneous impression that the whole food consumed went to increase the weight of the ox; and consequently, that if it eats none, it just remains stationary at a given weight! Urine of a more than ordinary dark colour may be flowing from the suffering animal. The perspiration may be dropping from its drenched sides, and smoking from its back, exposed to the burning rays of a summer's sun, or the frigid atmosphere of winter! and in this condition you may perceive the poor trembling animal threading its way through the crowded thoroughfares of the metropolis, with its troubled eye, and outstretched tongue, panting as if at the last gasp, and striding with its feet more than the ordinary distance asunder, as if afraid of dropping down from suffocation, and being run over by cabs, omnibusses, and the thousands of vehicles pressing forward with all the speed possible. Depressed nature appears sensible of its unhappy position; but parties accustomed to such a system of cruelty, are, on the contrary, rejoicing in it, and clinging to it with all the tenacity of an Irishman to drawing his plough with his horse-tail. "If nature, by the blessing of St Patrick, has purposely given to cattle long tails wherewith to draw the plough, harrow, &c., it is surely mighty fashionable on the part of the Parliament to put farmers to the expense of traces—a heretical system at the best, which will ruin ould Ireland." So argued Paddy in 1634, and so argue not a few of our metropolitan butchers and farmers of the adjoining counties in 1852! It is certainly humbling to think that there should be one farmer or butcher who would conclude that there is no waste upon the animal system, comparatively speaking, in connection with Smithfield cattle-market, with its *locomotive engine* system — suburban lairs and slaughter-houses scattered over an area of some thirty to forty square miles! The fat ox may leave the stall 400 miles hence on Friday evening—may enter the metropolis through the triumphs of steam at an early hour on Saturday, having been less time on the road—then subsequently a prisoner at the bar of salesmen in Smithfield! nay, be from three to five *days* in the metropolis, subject to the treatment already noticed. But although our beer-barrel has been ten times the length of time in the metropolis, subject to the same flow as

on its journey to it, yet less waste has been sustained by the brewer! Indeed, his loss is not worth recounting! The loss to the butcher by the railway is considerable—much more than by the drove; but since the ox entered the metropolis it has been in an Elysium—the real garden of Eden!

Waste, or rather defalcation of weight, it may be said, is very different under rest with a proper supply of food—as under the experiments of Dr Thomson, Boussingault, &c.—from what it is under fasting, exercise, and excitement, in marketing fat stock in the metropolis and other large towns; for, in the latter case, it is not equivalent to the elements of food worked up into the system, but the difference between the quantity worked up and the whole tear and wear upon it; and if the food is not worked up—as we have seen is the case when the stomach and bowels are deranged—then it is the equivalent of the whole tear and wear.

Again, when the ox is turned out of its stall, waste is greater the first day than the second, the exhausting causes being equal; and as it decreases in weight, waste becomes daily less and less. With this fact farmers and drovers have long been familiar—a fact which affords them little consolation. They are not only familiar with the fact that exercise is more exhausting the first day than afterwards, and that to avoid consequences it is generally necessary to shorten the first journey or two; or, where fat beasts join the drove on its way to market, to turn them out a few days previous to its arrival, so as to fit them for journey—and that the fatter they are it is the more necessary to attend to this practice; while extra fat, such as the first class exhibited at Baker Street, cannot be driven at all, but must be conveyed in cattle-vans. They are not only, we say, familiar with facts of this kind, but also with those already noticed relative to excitement, and derangement of the stomach and bowels—calamities which invariably accompany each other. If an ox, for instance, takes the road slowly, coolly, and free from excitement and derangement of the bowels, technically termed "scouring," or "purging," it will also eat well, and soon get over the great difficulties of the road; but if, on the contrary, it becomes excited, shying at everything in its way, derangement of the bowels, lameness, with a degree of fever, is the inevitable result—and to such a degree as frequently to render it necessary to leave it behind, if not dispose of it on the way at a sacrifice. Now, under the present system of travelling by railway, cattle are equally liable to excitement as when travelling by the drove, if not more so; certainly, when travelling by steamboats and subject to sea-sickness excitement is greater: consequently, in both cases, from the shortness of the time on the road, especially by the former, they arrive in the metropolis in a state less fit for travelling its hard and stony streets, and for standing in the market for such a period of time as they do, than formerly—a result which accounts for the complaints of butchers relative to butcher meat being in a

worse state since the introduction of railway conveyance than formerly. The meat, it is said, is more bruised by railway and steamboat conveyance, especially the latter, than by the drove. Now, the number of strokes, concussions, and pressures against the body of the ox, are neither more in number nor greater in magnitude, in its journey between the stall and the slaughter-house after the railway than by the drove; but the excited state of live muscle may render the effects produced very different, by every stroke, concussion, or pressure. The stroke which would injure meat in a state of excitement, will not injure meat when free from excitement; and according to the degree of excitement will be the injury sustained. Butchers themselves are familiar with the fact, that if they bruise or cut a finger, it will be more difficult to effect a cure when the body is in an excited or unhealthy state, than when otherwise. No doubt a certain force will produce an effect, whatever may be the state of live muscle and fat; but such cases are exceptions—exceptions not experienced in Smithfield by the drove, but experienced in Smithfield by railway and steamboat conveyance: because, by the former practice, beasts injured by the way were either left behind until they recovered, or were slaughtered; while, by the latter, there is no leaving behind, for, dying or living, all are brought to the metropolis.

Before the different committees of the House of Commons there was much contradictory evidence given on this part of the subject, but, from the above observations, it will readily be perceived how easily the discrepancies can be reconciled; for no sooner does the mind comprehend the whole facts of the case, so to speak, than jarring differences of this kind entirely disappear.

Granting that excitement is greater per railway and steamboat than the drove on an average, and consequently that waste during a given time is greater also, yet, from time and exercise being less, the farmer is a great gainer, realising probably little short of twenty shillings on every ox which enters Smithfield—a gain not indicative of the whole loss sustained by the drove system, as some appear willing to imagine, but the difference of loss between the railway system and that of the drove, including the difference of expenses; so that the waste attending Smithfield from three to five days, and twelve hours by railway, is still a question to solve.

The loss in weight during the whole driving to-and-fro system of Smithfield is very forcibly exemplified by the amount of matter given off from the lungs, and in the insensible perspiration and urine during cases of "foot-evil," fever, &c. In severe cases an ox of 1200 lb. is soon reduced to half its weight. In a few days 600 lb. of butcher meat of the finest quality is dissipated in the atmosphere from the smoking surface of the body of the poor panting animal. In such cases the heaving flank and troubled eye are very indicative of what is going on to the farmer, supposing he is ignorant of the indications of the pulse; but in the whole

system of Smithfield, busy habit, eagerly and instinctively following its beaten track, is blind to indications of this kind. Now, in the case of fever, who will question the daily loss of 100 lb. with a consumption of from 100 to 200 lb. of water, making a total waste of from 200 to 300 lb. daily?—and in the other, who has a right to question the loss sustained in Smithfield without water? Doubtless British landlords, on whom the loss ultimately falls; for if the farmer is obliged to purchase a broached beer-barrel, he just pays the brewer accordingly. In his habits he is practical, and perhaps as great a stickler to antiquated systems as the butcher. It does not increase or decrease that loss that practical men such as farmers and butchers cannot perceive it. The reason why they cannot do so may be because it is beyond the reach of their experience. Their attention may never have been drawn to the subject, and even if it has, they may be unable to comprehend it. They may even be ignorant of the fact that the animal system is daily undergoing change—that every breath which the fasting animal exhales carries with it a portion of its fat, (*carbon*,) and that the balance of fat (*oxygen and hydrogen*, *or water*) is carried off in the urine and insensible perspiration. To deny that there is a waste in Smithfield, and the whole machinery of Smithfield, is to deny that the ox breathes in the metropolis! which is absurd enough. That the facts of the case do not come within the experience of farmers and butchers is no argument that they do not exist, much less that they should be concealed from them by ignorance. If my beer cellar adjoins that of the butcher, and if I, by a little ingenuity, contrive to broach my neighbour's beer barrel instead of my own, and drink out of it as much as he does, if not more, it certainly does not follow that the quantity he himself has used is the quantity for which the brewer is entitled to payment. The butcher is responsible to the brewer for the whole quantity placed in his cellar. The brewer's loss is that between the cellar and his brewery. ***Ergo*, the metropolis is responsible for the whole waste on fat stock in it, now sustained by landlords.**

It may be said that the distance travelled multiplied by the time may be taken as an index of the loss thus sustained. What the average distance travelled by fat stock, in attending Smithfield, may be, we have not the means of ascertaining; but, within the metropolis, it can hardly be estimated at less than one diameter, or from six to seven miles; and, when we consider that the majority have to travel to lairs from the different railway termini, (as from F, A, and E, to N and M,) where such chords or distances are equal to the radius in many cases, and in some greater, and from the market again to lairs, to Woolwich, Maidstone, &c.—and sometimes to attend two markets before being sold—it is more than probable that ten miles is nearer the distance, or about a whole day's journey for the best quality of beasts. This conclusion, however, is liable to objection, for travelling one mile in the metropolis is more exhaust-

ing than travelling three miles along the grassy waysides of the country, according to the general opinion—an opinion which, we believe, falls under than above the mark. Consequently, the whole waste would be equivalent to that on three days' travelling without food, multiplied by the length of time in Smithfield market, and so forth. In short, the farther we extend our inquiries, the more enormous the waste of butcher meat appears to grow. It has been estimated, by parties competent to judge, at £500,000 annually; but, according to the data at which we have just arrived, it must exceed this figure a long way, incredible as it may appear.

The next interest of the farmer which we have to notice has reference to expenses in marketing. Here we have three items—railway conveyance, lairage, and marketage.

The first of these items is certainly not the least important one to the farmer, but, from its extensive character, and its being in some measure a separate question from that of a public cattle-market in a particular site, we shall not enter upon its merits at present, but proceed to the other two.

Lairage and marketage we propose uniting, and therefore shall discuss the two together. When the ox arrives in the metropolis it cannot be in all the corners of it at one time. After it is slaughtered it is subject to subdivision; but, previously, it can only occupy one space: consequently, if four areas are provided for it, there must always of necessity be three empty. Now, such being the fact, a fact which cannot be controverted, the propriety of making the ox *a locomotive engine*, travelling it from railway to lair, from lair to market, from market to a different lair, and from thence to the slaughter-house, if not to a lair contiguous, may be questioned; for every removal costs the farmer and the public something more than a reduction of butcher meat. Such may be a convenient system for the proprietors of lairs, but it neither suits depressed agriculture nor a heavily-taxed public. The area of land required for the lairage of an ox in the metropolis is valuable, and more so at the centre than the circumference. Now, as all landlords have a right to charge rent for their areas, and do charge rent for their areas, it obviously follows that one area is cheaper than four, and that that area would be cheapest at the circumference.

The different areas now under lairage, market, and slaughter-houses, far exceeds what would be necessary were the whole properly organised and combined together. The Smithfield system of separate lairage was constructed to suit a practice now a long way out of date, and at variance with the house-feeding and railway travelling of modern times—a system entailing upon depressed agriculture not only an enormous sacrifice of butcher meat, but an extra territorial expense, and expense of attendance. The territorial and driving expenses, with attendance in lairs and market, ought to procure for the ox very different accommodation and

treatment from what it now receives. In Free-Trade times farmers have surely a right to receive value for their money, which is not done under the present mulcting system—mulcting in all its departments.

It may, however, be said that the present system is no longer maintained, and that the city corporation proposed a central market which should have been adopted.

This, however, is a fallacious conclusion, for in principle the proposed scheme was the same as the old. It was just the old system of Smithfield upon a new site, with an intolerable increase of expenses upon the farmer, supported by no other argument than that butchers and bankers would be gainers!

Now, if a sufficient area for a market can be got cheaper in the suburbs than at the centre, and be maintained cheaper also, as it obviously can from what has already been adduced, then butchers and bankers should be taxed to pay the interest and redemption of the difference, and not the farmer who is a loser. Because he is already a loser to a vast amount, is certainly no argument that he should become a greater one, at a period too when his distress from this and other causes of a similar kind is acknowledged by Parliament to be intolerable. In short, the principle of improving the metropolis at his expense, as involved in the central scheme, is obviously unsound.

It may, no doubt, be argued that such an additional tax would advance the price of butcher meat to the consumer and not reduce it to the grower, which brings us to the next topic—*price*.

Nothing can affect price but supply and demand. In commerce this is a well-established maxim, so that it would be useless to entertain the contrary in the metropolitan cattle-market, where it is already acknowledged. Now, instead of diminishing the supply, we propose increasing it to the equivalent of £500,000 annually; and, besides this, from the contents which lately graced the Crystal Palace, it is very obvious that our late worthy visitors intend giving us not only an increase of live stock, but also of slaughtered meat both salted and fresh, with *beef*, *bread*, &c., so that for the future that supply regulating price will be increased from more sources than we propose. The absurdity, therefore, of talking of an increase of price is manifest.

The fallacy of the argument that a tax upon the live ox increases the price of butcher meat to the consumer, will appear obvious when we consider the fact that it stands upon the farmer's account along with all expenses in the stall, the same as the wages of the cattleman and the commission of the salesman, and, consequently, just reduces his income to the same amount, while it does not affect in the slightest degree the expense of growing that quantity of butcher meat which regulates the price in the metropolis.

Again, granting that an extra tax of this kind did increase the price to the consumer, then on what principle did the corporation

lay claim to compensation; for if an increase of a tax increase the price, a reduction of the tax must decrease it. Consequently, if the corporation loses £5000 yearly by the removal of the market, and if that tax is not continued, butcher meat must just be £5000 cheaper to the capital. It may be said that the corporation does not represent the whole of the capital. Granted; but it must be admitted that it justly represents its own claims. Now, its claims is a tax upon the farmer from which its own freemen are exempt, and, consequently, *a bondage tax* coming entirely out of his pocket.

Again, we are now arrived at a period in the history of England when people must study to give value only for value. Now, the farmer is not only to be called upon to pay value for what he does not receive, but to pay for what butchers and bankers receive! which, in commerce, is absurd enough. The honest course is obviously for bankers and butchers to pay the difference. What that difference might be, we did not take time to consider under the item of expenses, because it scarcely falls within the expenditure of any rational scheme. We are now advocating for principle rather than any specific plan; for the question before us is the least expensive of two systems—a dear market and dear butcher meat, *versus* a cheap market and cheap butcher meat. Suffice it to say, that it is a difference which butchers and bankers are unable to pay, and therefore would fall upon the consumer, under whose interest we shall briefly glance at it by way of objection.

Lastly, it may be said that the Central Market proposition would not involve a greater investment of capital than our Suburban one. Granted; but this can only be true under the hypothesis already disposed of—the greater investment at present in Smithfield, with its machinery of suburban buyers, and still greater investment by farmers, in manufacturing and upholding the *locomotive engines of Smithfield*—travelling fat oxen! At present farmers pay £5000 annually for sustaining a loss of £500,000, besides lairage expenses, &c., little short of a similar sum; withholding from the public butcher meat to the value of £500,000 annually, and hence increasing its price. Not content with this, our opponents *now propose to increase the price of butcher meat as a butcher-meat market improvement!*—certainly the grossest absurdity we have yet arrived at. When farmers or manufacturers hit upon an improvement, it generally enables them to reduce the price; but the year of the Great Exhibition has given birth to a different theory—*dear beef for a blessing!*

Second, The next party whose interest we have to notice is the bankers of Smithfield, who interpose between the seller and buyer as a third party. It has been said that sales are effected in Smithfield on the principle of *ready money*; but such is not the case, for the very profession of the Smithfield banker is to exclude

ready-money transactions by advancing capital on behalf of butchers to the farmer—relieving both the farmer and salesman from risk on the payment of a small sum; hence the transaction is a *del credere* one. The period of credit we believe is one week; and it is the shortness of this period, and the wealth and solvency of those butchers to whom capital is advanced, that account for the smallness of the charge made by bankers—a charge which must cover both the interest and *del credere* commission on the capital thus advanced. In the dead-meat market, sales are effected on the same principle—the price of an article sold being generally advanced by a third party; but in this case, salesmen, we believe, incur the risk, and hence their own commission includes the *del credere* commission also; for they complain of losses in their communication, so that these losses are its equivalent: consequently, if they had no losses to sustain, their commission to the farmer or consigner would be so much less. In the corn trade, sales are generally effected at three months' credit, and the interest on the advance and *del credere* commission extend the account as separate items; but differences of this kind in details do not in the slightest degree affect the principle of the transaction; for wherever a third party advances capital, as in Smithfield, a *del credere* commission must of necessity be involved.

The majority of Smithfield bankers, some say the whole, object to a suburban market.

Bankers, one would have thought, are the last party who would have objected to the purer air of the suburbs, for invariably they have their residences in it, and some of them several miles into the country, going to and returning from their offices daily. What argument they have, therefore, against a suburban market is best known to themselves; for we have never heard a single one advanced deserving of notice, and, consequently, are left to fight without an opponent. Are they *locomotive engines* also, preferring the greatest distance? If they have got other business requiring their presence at the centre, this only shows that they are serving two masters, and, consequently, that they must divide themselves into two parties—the one serving at the centre, and the other at the circumference. Such is not only the conclusion of theory, but also third parties would be gainers by such a subdivision of labour, if properly organised. If, on the other hand, we suppose that letters of credit can only be posted at the centre of the metropolis, owing to the organisation of banking machinery, so to speak, and, consequently, that, with a suburban market, they could not be conveniently posted on the day of the sale; what is the value of the argument? Simply that they can be forwarded to-morrow by the first mail—the practice now in force, generally speaking; for twelve hours of difference, considering the benefits lately gained by railway conveyance, would be immaterial to them, setting aside the fact that orders are seldom cashed

until the first market day, and not unfrequently the second and third. Probably, in the majority of cases, the butcher pays the Smithfield banker before the farmer presents the order for payment in the provincial bank. Hence the inference as to time, &c., and interest on the bankers' capital advanced, and *del credere* commission.

That many of the apprehensions of Smithfield bankers are groundless cannot be denied, but that some of them are otherwise, from the *del credere* character of their negotiations, appears to be equally plain; for, the whole of the present system being proposed to be overturned, and less expensive machinery demanded on the part of butchers, they would consequently have less security for their advances, while a proper knowledge of the pecuniary circumstances of butchers commencing business might with more difficulty be ascertained. Objections of this kind, however, have no weight in practice; for the object of all *del credere* advances being to enable the buyer to carry on trade with less capital, it consequently follows that the reduction of stock-in-trade contemplated by our scheme would be analogous to a *del credere* advance. If, for instance, a butcher required £400 to erect a slaughter-house and lair—and we have heard of more being invested—then, on the plan we propose, he would just require £400 less capital invested in stock, and consequently have this sum more of working capital. In other words, he would just require £400 less weekly of his Smithfield banker—a very good reason for his banker grumbling at the change. Now, if we suppose that the butcher buys at 6d. per lb., and sells at 8d., then we have 33⅓ per cent, (but say 30;) consequently £400 × 30, × 52 market days, gives us £6240 of yearly profit, or about £1500 per cent on cash transactions, including expenses, on the difference of capitals required.

The only valid objection of Smithfield bankers, therefore, furnishes us with a very nice argument in favour of butchers and their customers, to say nothing of the farmer and our scheme.

Third, Butchers and consumers are the parties whose interests we have next to notice; and as the latter are the principal—butchers being their servants, or dependent upon them for employment—it will be advisable to examine their interest first.

The fat-stock market which the inhabitants of the metropolis require, is that from which they will get the largest supply of butcher meat of the best quality, and have the least expense to pay for its distribution. So far the interest of the consumer harmonises with that of the grower.

We have here three topics to notice—supply, quality, and distribution.

1. The greatest supply is but another name for the cheapest butcher meat. Now, from what was said on railway conveyance, and waste on butcher meat in marketing live stock, it obviously follows, that unless the metropolis is radiated, so to speak, with

railroads, the site of the market should be in the northern suburbs, with slaughter-houses adjoining. On this topic, therefore, fresh argument need not be advanced in this place.

2. The best quality of butcher meat is a chemical question. That butcher meat slaughtered, cooled, and set in a cool and pure atmosphere, is of better quality than butcher meat slaughtered, cooled, and set in an impure and sultry atmosphere of too high a temperature, is a chemical fact which cannot be denied. Now the atmosphere in the northern suburbs of the metropolis is purer and cooler than the atmosphere at its centre; consequently, butcher meat slaughtered, cooled, and set in the former, would be of better quality than butcher meat slaughtered, cooled, and set in the latter. On a chemical question so plain and obvious, it would be superfluous to enlarge; for to deny the soundness of the conclusion at which we have arrived, would just be for metropolitan butchers to put chemistry under a bushel in the first year after the Great Exhibition.

The value of the difference in quality which would be gained is a question more liable to controversy; but that it would be something considerable, must appear obvious to every one conversant with chemistry, or the perishable nature of butcher meat. Farmers have long been familiar with the fact that a pure atmosphere is as necessary in the dairy as clean utensils. If once the milk is tainted by any noxious gas a few hours, it becomes useless; good butter can never be had from it afterwards. Equal attention must be paid to cleanliness and a pure atmosphere in the slaughter-house; for if once butcher meat becomes tainted, putrefaction follows at the gallop. With the rapidity with which butcher meat putrifies during the heat of summer, butchers have long been familiar, as also have farmers who kill for their own use. Such is the difference between the value of tainted and untainted meat, that the latter may be worth from 1¼ to twice the value of the former. In the dead-meat market, there is frequently a difference of from a farthing to a penny per lb. on meat not considered tainted, but which has not been received by salesmen in an equally good condition, though equally fat. Now, this difference may be occasioned by several causes. For instance, if an animal is hunted to death, it will not bleed so well as otherwise—or, as it is technically termed, "*die so well.*" The blood of such animals will not even coagulate. With these facts parties have long been familiar; consequently, every degree of exercise and excitement produces different degrees of deterioration of quality. Again, a difference in the mode of conveyance will injure quality; but when we say mode of conveyance, it must not be understood as distance, for distance is immaterial. Indeed, it may be said, on the contrary, that the greater the distance which butcher meat is travelled in a given time, so much the better. It is not distance, therefore, which affects butcher meat, but time, so to speak. We

are informed by some of Her Majesty's butchers in the west end of the metropolis, that butcher meat slaughtered in the cold atmosphere of Scotland is superior in quality to butcher meat killed in the southern counties of England, other things being equal, and will keep longer than that slaughtered by themselves, both entering the shop at the same time. *Distance of conveyance is of less importance than a cool setting room*—(a very strong and proper argument, we may observe, for suburban slaughter-houses.) Again, a slovenly mode of slaughtering may deteriorate quality. Now, in each and all of these cases, butchers know from experience that meat in such and such a state will not cut up equally well with meat which has been less deteriorated, and therefore will not suit a certain class of customers. It has not only been deteriorated in quality, and therefore must be sold at a less price, but there is also a risk of its being lost altogether; for tons of butcher meat, we believe, are annually lost in the metropolis and other large towns during the heat of summer, from rapid decomposition. Consequently, such being the facts of the case, we can hardly take a lower estimate of the increase in the quality of butcher meat slaughtered in the purer atmosphere of the suburbs than one farthing per lb. on an average, which would yield a total profit to the inhabitants of the metropolis of about £250,000 yearly—a profit, like the present loss of the farmer, so enormous as almost to appear incredible. But incredible as such sums may appear, and liable to objection, as we readily admit they are; yet, being theoretical deductions from facts, they are sufficient to call upon growers and consumers to consult their own interests apart from the prejudices of salesmen, bankers, and butchers, or even farmers themselves.

3. The distribution of butcher meat in London is a commercial question of a peculiar kind; for it is not distribution either in retail or wholesale, generally speaking, but the difference between the present wholesale system and that which we propose; for in many cases under the present system, if not the majority, butcher meat is carted from the butcher's slaughter-house to the shop—the first work, we should suppose, in the morning; while, on the other hand, all beasts have to be distributed from the market to the slaughter-houses. Now, both these items are engrossed in the account of wholesale expenses in opposition to retail; consequently, differences of this kind resolve themselves into the following simple and obvious question, viz.:—

After the fat ox is slaughtered, and his four quarters put into the butcher's cart at the suburban slaughter-house;—supposing the butcher himself in his cart ready to apply the whip, on the one hand, and supposing, on the other hand, his man, armed with his goad and dog, is ready to start from the same point with a fat ox;—then, under such an hypothesis we say, whether would the butcher or his man be first home—the latter driving through

the more densely crowded thoroughfares of the capital?—*i. e.*, Whether is the sum of two sides of a triangle or the remaining side the greatest?

To pass a hasty opinion upon a practical question of this kind, which can only be determined by experience, would be to decide the issue of a Derby day on the Thursday previous. If, however, we remove the position of parties, by placing the butcher's boy on the cart, there cannot be a doubt that he will be at home long before his opponent gets the length of the centre; for butcher's boys are universally admitted as being perfect Jehus in driving. Consequently, we arrive at the conclusion, that wholesale distribution from a suburban market and slaughter-house would be cheaper than wholesale distribution from a live-stock central market without a slaughter-house.

An objection formerly anticipated may be here advanced, viz.—That a central market with public slaughter-houses would obviate the extra commercial expense noticed above.

This proposition, however, involves the theory of central lairs as well as slaughter-houses, with railway communication from the circumference to obviate the commercial loss of *tare and tret*, or waste on travelling fat stock at present sustained by the farmer—a loss which we have shown ought to be borne by butchers, in the example of one man broaching his neighbour's beer-barrel; for the argument that salesmen send their unsold stock to suburban lairs, in preference to those immediately adjoining Smithfield, is only an argument that Smithfield should be removed to those lairs to save this extra travelling.

Now, the area which would be required by a central market with lairs, slaughter-houses, &c., cannot be stated at less than one hundred acres, sales being effected as at present; so that the extent of land now covered by houses would have to be purchased by the inhabitants—a railway made from the circumference to it, and worked afterwards gratuitously to farmers, conveying their stock free of charge. The proposition of a central market, therefore, resolves itself into the important question—Will the inhabitants of the British capital submit to be taxed to the extent of some £100,000 annually, and have their butcher meat reduced in value £250,000 at the same time, in order to chime in with the prejudices of butchers and Smithfield bankers? Nothing could be more absurd. No doubt, eighty acres of land could be purchased for money, a railway made, and a market, &c. &c., erected, so as to effect very important improvements both in a commercial and sanitary sense. Of this there can be no doubt; and it may also be taken for granted, that, had we to commence making a new metropolis from the foundation, the proposition of a central market might be safely enunciated; but, with the metropolis as it is, it must appear the height of speculation in every one who can approach the subject free from prejudice.

On each of those three heads, therefore, affecting consumers, we find that their interest reciprocates with that of growers—that both would be great gainers by a suburban market, but losers by a central one; and that to relieve the butcher would be to entail upon the inhabitants of the metropolis an enormous expenditure in cash, besides the greater loss of receiving an article depreciated in value. In practice, it is more than probable that the farmer would come in for a share of the benefits gained by superior quality, as well as greater quantity; for there cannot be a doubt but that deterioration of quality in Smithfield reduces his price at present, crippling him from competing with foreigners; so that it may not be far from the truth to suppose that growers will benefit by the whole of the extra quantity, and consumers by the superior quality, estimated at £500,000 and £250,000 respectively—total, £750,000.

To reconcile the conclusion we have just arrived at, with the interest of the butcher, is our next problem. A large majority of the butchers of the metropolis are against a suburban market. In short, they are practical men, plodding in the footsteps of their forefathers, and do not relish being turned out of them.

Because the majority of practical farmers and practical butchers are averse to a change, and prophesy ruin from it, it appears to be taken as a conclusive argument with some why no change should take place. But in changes of this kind, majorities go for little, for the majority of Irish farmers were against the Parliament for imposing upon them the extra expense of traces in 1634; and, for similar reasons, railroads and steam-boats have been opposed in modern times by parties whose rights and liberties were equally endangered. We are obviously living in times when the progress of the arts and sciences is demanding of every one more work to-day than yesterday; and before such demands can be complied with, chemical and mechanical assistance must be called to our aid. In 1852 there is no standing still in any branch of British industry, so that he who is not progressing is falling behind. The demand now made upon farmers illustrates the truth of this conclusion; and that about to be made upon metropolitan butchers will, we apprehend, farther show that farmers are not the only parties who have lately been standing still in the march of improvement: for although butchers may have to perform a little extra labour in attending the live market and the slaughter-houses in the suburbs, yet we are afraid that they will not obtain higher profits than they now do, unless they call to their aid chemical and mechanical assistance. If they do so, which we have shown is practicable by our scheme, then, instead of being losers, they may be the greatest gainers; for although many grumble at the difference between the farmer's price and consumer's price, as being a profit incompatible with the principles of Free Trade and the subdivision of labour, yet, from the extraordinary expense of

the present system, it may be possible, with superior machinery, to derive a greater profit from a less difference. In all the other branches of industry, this result has been obtained; and why should it not be so among butchers? At present, the general retail trade of the metropolis appears to be undergoing a species of revolution. Certain birds have been known to build their nests in a particular spot during the whole of their lives; season after season the happy pair have repaired the sacred habitation which probably gave them birth;—and for no other reason certain families have purchased their goods at certain shops for the whole period of their lives, consequently their instinctive habits have become articles of merchandise. In many favourable localities a good business is worth £1000, or some such princely figure. Instead, however, of now purchasing the good-will of the trade at £1000, this sum is invested in stock of a different kind than the instinctive habits of patriarchal times. Reason is now triumphing over instinct, and many a merchant, no longer tied to the routine of patriarchal habits himself—much less disposed to purchase those of others in times of such novelty—having started where he found he could start the cheapest, is now scouring the metropolis; while many families find better bargains knocking daily or weekly at their doors from the opposite side of the metropolis than they formerly did at shops adjoining, to which habit had instinctively led them. Again, if parties can have butcher meat delivered in the metropolis from the Scottish capital at 3s. per cwt. of railway carriage paid by the Scotch butcher, what will it cost them from a suburban market? The conclusion that a certain number of butchers would not attend a suburban market, and, consequently, that the demand and price would be reduced to cover the expense of carriage, is just an argument that so many butchers would cease to be butchers, and that, consequently, their situations would soon be filled with others; for, so long as Englishmen eat roast beef, there will be no want of Englishmen friendly enough to supply them with it on as reasonabls terms as their northern neighbours. The examples of Maidstone, Dover, and Brighton prove this; for from the butchers of those places the farmer gets as high a price as from salesmen in Newgate and Leadenhall, *if not the higher of the two*—a fact which farther proves the truth of the conclusion already arrived at, that price to the grower and consumer is not dependent upon the distance of the butcher from the market. On this point, therefore, the sooner that butchers satisfy themselves the better; for that an increase in the supply will reduce the price to both grower and consumer, and a decrease, by increasing the demand, increase it, have already been shown as fundamental principles in commerce; but that four thousand metropolitan butchers and salesmen, by taking the pet at the progress of reform in their department of industry, will affect the price to any party, appears very problematical; for as we have now a

surplus stock of young farmers, equal at least to this number, annually, as one of their number, we should be glad to see the whole get good situations for one year. Doubtless they are the parties who would soon learn to handle the steel to the old folks' advantage, as well as their own, without injuring their customers; for many of them kill to supply their father's tables already, and could start on the cheapest plan, and with the best machinery. That the present system is an expensive one cannot be denied by butchers themselves; and that the one we propose will require less capital in stock has already been shown. Let no one, therefore, cling to an antiquated and expensive system for fear of getting worse, until too late to retrieve consequences; for if once the carts of more industrious and persevering parties are beginning to stop at customers' doors with a better and cheaper article, it will be too late to talk of a change of practice, or selling the good-will of the business.

Many of the inconveniences arising from a more distant wholesale market might be obviated by butchers adopting the practice generally, which some of them now do, of residing in the northern suburbs, so that they could make their purchases in the morning before leaving for their shops, or after they returned at night, and also see after the slaughtering department, &c. There is scarcely a single occupation in the metropolis which affords greater facilities for enjoying the purer atmosphere of the suburbs than the butcher trade, for the whole shop business is performed in the forenoon, leaving the entire morning from five to nine, and from five to nine in the afternoon again, free, comparatively speaking, or with duties which any servant could perform. If a butcher attends to his shop from nine in the morning to five in the afternoon, there is no fear of his business being neglected. No doubt changes would have to take place in the arrangement of shops, so as to avoid expenses; but objections of this kind to the introduction of a system go for nothing, for if space is more valuable at the centre than the suburbs, it consequently follows that butchers would be gainers by such a change as that which we now suggest. At present many of them could let the upper part of their houses to their foremen and servants, or better tenants if they got them. Sub-rents might equal the rents of landlords, so that shops would be rent free. In other cases, a foreman might reside in the suburbs, and look after the slaughtering department; while, perhaps, in more cases, public slaughtermen would perform the work cheaper and equally well. Butchers who had not men might find it better to employ slaughtermen; while those who had men qualified for the purpose might slaughter their own beasts. In the generality of cases, we believe small butchers at present are betaking themselves more and more to the carcass market for their weekly supplies than formerly; and it is but reasonable to suppose that such a change as that in contemplation would make them place more reliance

still upon that quarter for them, seeing they would get a better article.

In discussing the topic of a suburban market, butchers invariably advance the experiment of Islington as a sort of bugbear or objection—than which scarcely anything could possibly tell more against Smithfield and the rottenness of its whole commercial system; for on such occasions the whole theory of commerce is trampled under foot—supply and demand, for instance, with the quality of the article offered for sale, and abundance of capital, have no effect upon the market! This erroneous view of the subject is deserving of our most serious consideration, because it involves the moral character of both butchers and salesmen; for the conclusion that a suburban market would give rise to a practice of interjobbing, is neither more nor less than a conclusion that salesmen would either sell under value, or that butchers would purchase above it, from a class of jobbers only. That cattle were bought in Islington market and sold in Smithfield is plain Irish! more becoming the annals of Donnybrook than the commerce of the British capital. Do Woolwich, Chatham, Maidstone, Dover, and Brighton butchers, only buy of jobbers because they are farther from Smithfield than St Paul's Cathedral? Or is it only because Cockney butchers do not like cheap bargains! that they would buy from jobbers? Or pure aversion to the purer atmosphere of the suburbs? Or perhaps they are conscientious people? and hence would not accept the undervalue-bargains of salesmen! This is certainly saying the utmost we can for them; and, in return, we hope for the future they will kindly unburden their tender consciences to the representatives of the farmer, when all will go well. In Smithfield itself a similar practice of jobbing exists. Some farmers, for instance, inexperienced in Smithfield commerce, on attempting to sell their own stock, are taken the advantage of by jobbers, who purchase under market value, and re-sell to butchers at a profit sometimes amounting to several sovereigns per head! But conduct such as this is only an attempt to exclude farmers from selling their own stock, and proving that the commerce of Smithfield is subject to reform; for if farmers had the means, as we subsequently shall show they will have under our scheme, then they would just get as high a price as salesmen; for whatever price farmers may get, it is seldom that they err in asking too little in the outset. Now, if a farmer asks £24 for his ox, and if he cannot get more than £19 from a butcher, but £20 from a salesman; and if that butcher gives to that salesmen £24 for the ox, then the transaction subjects the commerce of Smithfield to conduct the most reprehensible. Parties may laugh, jeer, and even boast of such conduct; but looking at it, as it ought to be, it only farther illustrates how far Smithfield has fallen behind the general character of English commerce, requiring the interference

of the pruning-hook. It may be said that the farmer was an ignorant old fellow, and never asked more than £20 for his ox. Granted; but how does it happen that the salesmen is the fortunate purchaser, and not the butcher? In short, the more we investigate such transactions, the more anomalous appears the commercial character of Smithfield, (for when we here say salesman and butcher we mean the respective professions;) for every market conducted by salesmen ought to be one conducted on principle, with the most scrupulous exactness—the appearance and conduct of farmers being always treated with the greatest deference; and instead of taking the advantage of them, their short-comings or want of judgment should be faithfully supplied by salesmen. Conduct of this kind would be reciprocated by farmers, convincing them of the propriety of employing salesmen instead of leaving their farms; while such conduct as that given in the example quoted, produces a widely different effect—conduct which more than one farmer has complained of—conduct which every intelligent salesman ought to put down. That examples of this kind are exceptions from the general practice, we need hardly say is the case; but this is not the question at issue, for the question at issue is the quotation of such examples by ignorant butchers and salesmen as the general practice of a suburban market; so that our readers will perceive we are not running down the character of salesmen or butchers, but the contrary;—for both we have the highest respect.

Such is the interest of the opposite parties, resolving itself into a plain question in chemistry and mechanics; for the interest of grower and consumer of butcher meat are not opposed to each other, but are in perfect harmony. From the miserable state of those sciences, in the present system of Smithfield, they sustain very heavy losses, especially the farmer, from which improvement would set them free, conferring upon both very important benefits, more particularly acceptable to the farmer, from the present depressed state of agriculture. On the other hand, we have seen that the opposition to those improvements is principally, if not wholly, prejudice, based upon antiquated habits. Practically, no doubt, losses must always be sustained by some parties to a certain extent, consequent upon changes so great as that which we propose. Irish farmers experienced this consequent upon the passing of the act of Charles II. in 1634. The colt, for instance, would not only blister its shoulders, but not unfrequently break its traces —evils of no ordinary magnitude in those simple times; but, at the same time, they certainly formed no valid objections to the mechanical improvement in question, much less entitled the owner of the colt to compensation from the exchequer. In short, in all ages, improvement has been considered an innovation upon the rights and privileges of a certain class of labourers, while others have rejoiced at the progress. The *loy* and *caschrom*, for

instance, have been superseded by the plough, the distaff and spinning-wheel by the steam-engine and jenny—but not without giving rise to serious losses, and still more serious apprehensions. Consequently, we can hardly suppose that the placing of the *locomotive engines* of Smithfield, with the lasso and goad, upon the shelf, will form an exception. Nevertheless, science has progressed, and will progress, and the sooner that parties make up their minds to join heartily in the march of improvement, the sooner they will consult their own interests. Startling as our next and seventh proposition may appear, which involves the second part of our subject, when we come to discuss it we will find it but a step in progress soon to be left behind by the triumph of modern science, chemical and mechanical.

THE FARMERS' NOTE-BOOK.—NO. XXXVI.

*French Husbandry.**—In a recent number we reviewed the second edition of *The Book of the Farm.* Our intention in doing this was not to dwell upon the leading traits of modern and Scottish agriculture, of which the work in question affords so lucid an exposition, but to give such of our readers as were not acquainted with the book, some idea of its scope, and of the mode in which the author treated his subject. But when we had closed the last page of *The Book of the Farm,* we not unnaturally turned to the perusal of Du Bois' *Farmer's Encyclopedia,* which has for some time been lying upon our table; and we think that some account of it, and of the mode in which French farming is conducted, may not be unacceptable to our readers.

Like *The Book of the Farm,* the *Encyclopédie du Cultivateur* has reached a second edition. Like it, too, it is avowedly based upon experience; its author professing that it contains the results of forty years' practice, and two years' observation in foreign countries. But were it not for this statement, we should be at a loss to decide whether the writer were a practical man or not. Unlike *The Book of the Farm,* the contents do not indicate whether its author is really familiar with rural affairs, or a mere theorist. In this respect the *Encyclopédie* affords a strong contrast to the production of Mr Stephens. As M. du Bois' volumes were finished some time ago, they are behindhand in modern agricultural science. Besides farming proper, they include veterinary medicine, gardening, &c. We, in the following remarks, confine ourselves altogether to the agricultural portion.

* *Encyclopédie du Cultivateur ou Cours Complete et Simplifié d'Agriculture.* Par M. Louis du Bois. Paris : Roret. Agent pour l'Ecosse, Robert Seton, Edimbourg.

He commences by some very judicious observations upon the respective value of theory and practice, and then proceeds to describe the various kinds of soils. This part we pass by, and go on to his next section, which is on enclosures. He strongly recommends them; but his admiration carries him rather too far, and he expatiates upon the utility of hedge-rows, and actually recommends the hedges to be composed of oaks, elms, birches, &c., placed at from 12 to 18 feet apart, and between these trees he plants willows. Thorns he disapproves of, on the ground that they are very difficult to cut; but he allows them in situations where the farmer is exposed to the trespasses of cattle, or the invasion of thieves. Stone dykes he altogether dislikes. Such, he says, are dear to begin with, cost much to keep in repair, and, what is doubtless of consequence in a country where fuel is scarce, produce nothing for the winter's fire. Ditches are in somewhat better favour with M. du Bois; but his heart is evidently in his hedge-rows. He admires large fields, and, when alternate husbandry is followed, fixes the extent at from 20 to 30 acres.

He denounces small farms, unquestionably the bane of French agriculture. There can, we think, be little doubt but that the views of benevolent but mistaken philanthropists upon this subject in this country, would, if carried out, be productive of great injury. Farm operations, so as to produce food for the community and profit to the cultivator, must be performed upon a sufficiently extended scale. We pass over M. du Bois' observations upon this head, as also his dissertation upon the animals that should be employed upon a farm to labour it, and proceed to a brief notice of the relation between landlord and tenant in France.

That the soil in this country is almost invariably more successfully cultivated by a tenant-farmer than by a proprietor, is, however inexplicable, a fact that may not be questioned. M. du Bois states that exactly the same is the case in France. "It is," he says, "advantageous to the general interest that the greater part of the country be possessed by one class, and farmed by another. Unquestionably some proprietors cultivate with skill, improve their land, and produce good crops; but, in general, the farmers get better harvests, execute their work in a superior manner, are more economical, and deliver to the public more surplus food, and when leases extended over a sufficiently long period, so as to give the farmer a return for his advances and improvements, the land itself gains by being cultivated by him." If we recollect aright, Arthur Young, in one of his tours, expresses in numbers the difference between the money-return to a proprietor-farmer, and to a tenant-farmer.

The length of leases seems to vary very much in France. One spoken of in terms as if it were a common one, is for nine years, with a break on the side of both proprietor and tenant at the end of

the third and sixth year. If any improvement is wished to be effected upon the farm, this form of lease, as Du Bois very justly remarks, will never do. The term he recommends is from twenty to twenty-five years. Leases for life, or for any uncertain period, he denounces. He prefers entry to a farm upon the 31st of December. Payment of rent in kind he disapproves of. Such, however, we believe, is common in France.

The important subject of manures has always received more attention in France than in this country. Manures proper, or *engrais*, he divides into two classes—those that afford nutriment to the growing crops, and those that stimulate vegetation. First and foremost, among the former, is of course excrementitious matter. His management of dunghills seems proper enough. Liquid manure tanks appear not common in France. The liquid manure is recommended to be applied either in spring or in the months of September and October. He describes a method that they have in Normandy and other parts of France, of saturating in liquid manure square masses of compressed dung, whose four sides are squeezed tight with bands of straw, for future use. Du Bois considers this plan an excellent one. He advises dunghills to be protected from the sun and from rain, or, at any rate, to be covered over with a stratum of earth. The following short extract will give an idea of what is considered in France the comparative value of this class of manures:—

"The excrement of animals furnishes immediately, and continues to do for a pretty long time, good aliment to vegetables. The excrement of the pig is the most abundant in the principles of fermentation; and, consequently, the most energetic in its action; that derived from horned cattle is cold, but has much durability; that of horses is very hot, and very active; and that of sheep little enduring, but extremely active." Du Bois' advice is to mix them altogether.

Bones are justly esteemed, and Du Bois' plan is to put them in heaps, and allow them to begin to ferment. He also uses hoofs, feathers, oyster and mussel shells, and hair. The water in which wool has been scoured, he regards as particularly nutritious.

His manure that stimulates vegetation is lime. After entering into details regarding it, he passes on to *amendements*—that is, substances added to the soil to improve its condition; as, for example, adding clay to sandy soil, sand to clayey, and so forth. We pass over all this to consider the French system of rotation.

Upon the importance of a fixed rotation, he quotes Chaptal, with an approbation in which we most cordially join. "In my eyes," says that author, "a good system of rotation is the best guarantee of success that the farmer can give himself; without it everything is vague, hazardous, and uncertain." The greater

part of France, and formerly the whole of it, is cultivated upon a three years' shift, which is very properly pronounced a vicious one. We extract two examples of this shift:—

I.			II.		
1st	Year,	Barley, dunged,	1st	Year,	Oats, dunged.
2d	Do.,	Wheat, without dung.	2d	Do.,	Wheat, without dung.
3d	Do.,	Fallow.	3d	Do.,	Fallow.

Of the plan followed in better cultivated districts, we give two examples. According to our practice, they seem unnecessarily complex:—

1st	Year,	Potatoes, dunged.
2d	Do.,	Oats, with clover seeds.
3d	Do.,	Clover.
4th	Do.,	Cabbage, turnips, Lapland cabbages, (we think kohl rabi.)
5th	Do.,	Wheat, dunged.
6th	Do.,	Vetches and peas.
7th	Do.,	Barley, and barley for cutting.
8th	Do.,	Beet-root and Jerusalem artichokes, dunged.
9th	Do.,	Spring wheat.

In the above rotation several things at once strike us as opposed to our practice, and indeed principles. When we grow two kinds of cereal grains, we never take oats after potatoes. Then, of all cereal grains, oats is the very last we should fix on to sow clover-seeds among. In this country, turnips and cabbages, too, certainly require to be upon land recently dunged. On the other hand, we should prefer the wheat in land dunged for the previous crop. The other shift we alluded to is one followed in the south of France. It likewise extends over a period of nine years:—

1st	Year,	Wheat.
2d	Do.,	Rape.
3d	Do.,	Oats, with clover seeds.
4th	Do.,	Clover.
5th	Do.,	Clover.
6th	Do.,	Wheat.
7th	Do.,	Potatoes, or some leguminous plants.
8th	Do.,	Rye.
9th	Do.,	Potatoes.

The next subject that occupies M. Du Bois' attention is the tilling of the ground, and the more important of the implements of the farm. Of these latter he gives pictures, and, with one exception, they are most barbarous; and that one exception is a "charrue Anglaise de Small." We pass on to the cultivated crops of France. We regret, however, that the description given of the varieties is so vague and meagre, that we can seldom recognise them.

Wheat is in France, as with us, the most important cereal, and is the one principally employed for human food. A great many sub-varieties of it are cultivated in France, but Du Bois classifies them into two divisions, the tender wheat and the hard wheat. The former derive their name from being more easily crushed under the teeth than the latter, and seem to be the same class of wheat as we grow in Great Britain. They are cultivated in the middle

and north of France. The hard wheat is confined to the south, and has been obtained from the east of Asia; it does best, says Du Bois, as spring wheat. The culture of wheat in France differs little from that followed here: the seed is pickled, lime being employed. The hard wheat, however, is considered not to require this operation. It is sown from August to May, but probably in September. Broadcast sowing is the common one, but it is also both drilled and dibbled; considerable pains seems to be taken in keeping it free from weeds; and when harvest comes, it is cut down with either a scythe, a sickle, or a Hainault scythe; and of these three modes the first is considered the best and most economical, but in very hot weather it is found necessary to use the sickle. Thin-sowing is found to produce a better crop than when an excessive quantity of seed is used. The crop obtained seems (speaking rather vaguely) to be from twenty to sixty bushels per acre.

Rye is a cultivated French crop. Its applicability to light soils, and its early coming to maturity, are its advantages; and it is supposed, probably without cause, to exhaust the soil less than wheat. They possess three varieties of it in France—the common winter rye, a spring sort, and one called June rye, grown in the north of France, and which is sown in that month, cut down for forage in autumn, and a good crop obtained from it the following year. The French farmers still, we notice, continue the bad custom, once prevalent in this country, of sowing wheat and rye together. This was known by the name of *meslin* here; our neighbours, we see, call it *méteil*.

We were somewhat surprised to find that Du Bois states that, in France, the rye is more productive than the wheat. It gives, he says, however, less bread; but one reason that its culture is, perhaps, a little abstained from, is its liability to ergot, and the fearful consequences produced by bread made of ergoted rye.

It is, says Du Bois, particularly in Sologne, in the department of Louvet, that the ergot is very common, and that it occasions a dry gangrene which causes many to perish. It likewise kills the cattle. When this dry gangrene does not destroy the unfortunates who have eaten of bread into which ergoted rye has entered, they are liable to lose their limbs, and to very troublesome fits of palsy. In 1790, in one commune of the department of Sarthe, nine individuals of one family were victims to this accident; seven of them died; and of two infants who survived the poisoning, one lost a leg, and was left deaf and dumb. In the department of the Vendée there were, during the summer of 1800, four unfortunate farmers whose arms fell off at their wrists, in consequence of dry gangrene, produced by eating bread made of ergoted rye. It would be easy to cite many other examples of this kind; but these may suffice to dissuade from the use of a poisonous substance which is but too abundant, particularly in cold and wet seasons.

It would seem from M. Du Bois that barley is little grown in France, and that even that little is mainly confined to the south. Their vineyards yielding them beverage and spirit, the French have no occasion to produce a grain for the purpose of fermenting

it. They possess besides a two-rowed variety, a six-rowed one, or bere, which Du Bois states to be one-half more productive. The practice, according to Du Bois, ought to be to take barley after either peas or potatoes, although he admits that it does well enough after turnips.

The only two things that we notice peculiar in the French cultivation of the oat is, that they steep the seed, and often sow it in autumn.

Buckwheat is too precarious a crop to be depended upon even in France. According to Du Bois, if it do not rain at the time of sowing, it does not thrive; and if it do rain when it is blossoming, it is very liable to blight; it also is injured by too hot a sun; and if there come on slight frosts in the beginning of October, there is no hope of a crop. It is nevertheless an enticing crop, as it occupies the ground only from June to the beginning of October, and yields such an extraordinary produce—no less sometimes, according to our author, than a hundred-fold. These advantages have led the French farmers to seek out a hardier variety, which they would appear to have found in the Siberian buckwheat, which is, moreover, said to possess an even superior fertility than the common. We do not know if this variety has ever been tried in this country.

Of cereal grains are also cultivated—mainly, however, in the south of France—maize, millet, and sorgho. The last plant is unknown to us. Flax and hemp are cultivated French crops, but there does not appear anything very peculiar in their management. Among the plants cultivated for their oil, the first in the list is the poppy, a plant that has sometimes, though we believe rarely, been grown in this country for the sake of its concrete juice or opium. This opium is obtained from wounding the green top-seeds, and Du Bois assures us that this operation in no way affects the formation of the seeds. The cultivation of other oleaginous plants is described, the two most important being colza and rape. There is nothing, however, particular enough regarding these to detain us.

Of all root crops, Du Bois raises to the highest rank the carrot. It is, he maintains, much preferable to turnips, Jerusalem artichokes, or even potatoes. Among some real properties, he maintains that if a number of cattle be fed on any given acreage of carrots, the dung obtained from them will manure twice as much space. He describes a curious rotation, suitable, we suppose, to a sandy soil, which, although far from applicable to this country, may be interesting.

1. Rye, with carrot-seeds sown amongst it in March.
2. Hemp, with clover-seeds.
3. Clover.
4. Do.
5. Rye, with carrot-seeds, sown in March.

In order to hasten the germination of carrot-seeds, he soaks them in water, and places them, enveloped in a coating of moistened sand, in a dunghill that is fermenting. He allows them to remain here for four or six days. He says, as indeed seems very likely, that this plan is perfectly successful.

A very brief space is allotted to the subject of turnip culture, and we suspect that in French husbandry turnips are by no means considered the important crop that they are here; moreover, Du Bois' culture of the turnip is radically bad. He knows, indeed, that they *may* be sown in drills; but from the mode in which he speaks of these, he evidently is practically unfamiliar with them. He admires broad-cast sowing of the seeds, a custom justly censured by Mr Stephens; and, above all, he recommends them to be grown without manure, which, he says, causes them to be attacked by insects, and communicates a disagreeable odour to them. It appears to be a common French practice to take turnips as a second crop, after a previous one, the same season, has been removed from the ground. But we have the authority of Boussingault for saying that, at least in Alsace, this produces a very poor return.

From the root crops Du Bois passes on to the culture of the leguminous plants destined to ripen their seed. First of these he enumerates the pea. The only thing worthy of notice regarding the French culture of this pulse is, that he recommends the drill to be alternately one foot and two feet apart. When treating of bean culture, Du Bois recommends the ground, if light, to be rolled, and to soak the seed in soot and water. He also mentions of growing beans for the purpose of ploughing into the ground when green. He likewise speaks of growing beans sown broadcast, as a shelter for young grass-seeds. Vetches are occasionally grown in France for the sake of their ripe seeds. Du Bois says that they are particularly useful for feeding pigeons and sheep, but that they are bad for both poultry and pigs. This latter statement must surely be a prejudice. He also considers the vetch a very proper plant for ploughing into the ground. The proper time for doing this is, he says, during the period of flowering. Another cultivated French crop is the lentil, which, however, Du Bois dismisses in half-a-dozen lines. The other two plants in this division are the lupin and the chickling vetch, (*Lathyrus sativus.*) This latter plant was forbidden to be grown in some of the German states, owing to its being supposed to induce palsies, &c. Du Bois says that when eaten green it is wholesome enough, but that bread made solely from its meal is unquestionably dangerous.

The treatment of the artificial pastures differs from that followed in this country, mainly by the greater prevalence of lucern and sainfoin, and from its being customary to sow clover alone,

although Du Bois is acquainted with the practice of mixing rye-grass seeds along with it. The *Trifolium incarnatum* is known; it only admits of being cut once. Another artificial forage plant upon which Du Bois bestows great commendation is burnet, a plant hardly ever grown in Scotland, although still sown in England. It is produced in France upon poor, dry, and arid soils, and is in many localities the only forage plant grown. It lasts, according to Du Bois, with whom it seems to be a favourite, from twenty to five-and-twenty years. The leaves of the beet are also used in France; and Du Bois likewise furnishes a pretty long list of occasionally cultivated forage plants.

We pass by the cultivation of woad and madder, to dwell for a second upon two crops common in France, but never seen in the fields of this country—beet-root for sugar, and tobacco. Beet-root was introduced into French culture owing to the prohibition, by Napoleon, of our West Indian productions; and we believe that beet-root sugar is still protected by the French. The following table is interesting, as giving an idea of the estimated profit of French farming, the rent of land, and the expenditure in labour. "In the departments of the north," says Du Bois, "we may fix the price obtained for beet-roots at fourteen franc (11s. 8d.) the thousand kilogrammes, (a kilogramme is rather more than two pounds.) Hence we can make the following estimate:—

	Francs.		Shillings.
Rent of a hectare (2½ acres) of good land, . . .	60	=	50
2 ploughings and 2 harrowings, ...	120	=	100
Seed, 10 francs; sowing it, 6, ...	16	=	13¾
3 weedings and hoeings, ...	36	=	30
Lifting and carting, ...	45	=	37
Dung, (half for grain crop,)	100	=	85
Profit, ...	43	=	36
	420		

These 420 francs are the price which thirty thousand kilogrammes of beet-root obtained from a hectare would produce—that is to say, for one thousand kilogrammes, 14 francs." In the appendix to the *Encyclopedie du Cultivateur* there are some statements that are by no means reconcilable with this. The crop is put down there at but twenty thousand kilogrammes to the hectare, but the price set upon the thousand kilogrammes is higher. But perhaps he refers to a different part of France. He states that from an arpent (half a hectare = 1¼ acre) of beet-roots, from five to six hundred pounds of brown sugar were obtained.

The regulations of the French customs cause our Gallic neighbours to cultivate beet-root for sugar. Those of ours, by a singular anomaly, prohibit the culture of tobacco. But the mode of growing and managing this plant, as described by M. Du Bois, is interesting, but too long to extract.

Du Bois is pretty full upon the management of pastures. We will not observe, however, that we infer from his work that the French custom is to top-dress such with farmyard manure. We likewise pass over his account of haymaking, in order that we may regard the French modes of managing live stock. The following is Du Bois' description of what he considers the perfection of horned cattle :—

"It is not," he writes, "without reason that we seek for and prefer in these animals a large forehead, a short head, large ears, strong horns, big eyes, big nostrils, the muzzle flat and strong, the shoulder brawny, a thick neck, a vast chest, a dewlap falling low, large buttocks, short and thick legs, a back that folds in, a very long tail, a thick hide, but soft and flexible; strong feet, and the hoofs large and stout. Horned cattle who, to these qualities, add docility, and soft and even hair, whatever be their colour, nearly reach perfection."

He limits the time when a bull should serve cows, from his third year to his ninth; but the custom in France is to employ them at a much earlier age. Male calves not intended for bulls are castrated either when very young, or sometimes when from three to five years of age. Du Bois thinks, and we dare say he is right, that the latter mode of proceeding renders them stronger for field labour. In France they allow two oxen to cultivate seven hectares (about twenty-one acres) of arable land, and they estimate their draught at a thousand kilogrammes, (more than two thousand pounds.) They work oxen from their third year to their tenth, and then fatten them. In winter, spring, and autumn, the hours for field labour are from nine in the morning until four or five in the afternoon. In summer they work from the point of day to nine o'clock, and from two in the afternoon to sunset, save in very hot weather, when they do not yoke until four in the afternoon.

In some parts, we are informed, collars have superseded the employment of the yoke. In hot weather the working animals get water to drink, into which vinegar, and sometimes saltpetre, has been added. This reminds us of the old Roman custom of giving their oxen, when ploughing in very hot weather, wine. About twenty pounds of mixed hay and straw is a daily French ration for one of those working oxen.

Horned cattle are fattened both on grass and in byres. Their treatment in these latter is not devoid of interest, but we omit it to get some gleanings from a chapter entitled "General Observations upon Cattle." Cattle, we learn, are in France purposely put up to fatten later than is our custom; and seven years appears to be considered a reasonable age for this purpose. Then the practice of spaying heifers would appear to be familiar; and Du Bois asserts that heifers so treated fatten more rapidly than oxen. He also regards a few bleedings as causing the more rapid deposition

of fat. He is quite aware that warmth and darkness promote fattening, and he orders stall-fed cattle to be curried. He regards, as a moderate but sufficient allowance for an ordinary-sized ox, about thirty pounds of hay, and twenty of either carrots, turnips, or some similar root, with an additional twenty pounds of meal. The provincial breeds of France are numerous, and differ a good deal from one another, particularly with regard to the weight to which they attain. Thus the Normandy ox is set down as reaching to more than 1200 lb.; that of Brittany, to about 500; while those from Sologne are still lighter. From the preference always shown in the Encyclopedia to Norman breeds, we suppose the author to be a Norman. His account of the Norman cattle-trade, contained in this section, is not without interest. We are told that the cattle-driver, when going for his herds, journeys, of course on foot, about forty miles a day; that when he is in charge of his beasts, he drives them less than half that distance; that with the aid of his dog he can drive from twenty-five to forty. His daily wage is three francs, that is, half-a-crown. The cattle-dealer who goes about the country buying fat stock, travels on horseback, and Du Bois says that he journeys about forty miles a day. The sum he is, according to our authority, entitled to spend per day, is less than five shillings.

As far as we understand, in Normandy the measure of land is the same as ours, ("l'acre, qui se divise en quatre vergées composées chacune de quarante perches.") According to our author, they can fatten on an extent,

Of the best quality, of	120 perches, . .	1 large ox.
Second do.	200 do., . .	1 middling do.
Third do.	160 do., . .	1 small do.

The rent of grass parks of the best quality is from £4 to £4, 8s. per acre; of that of second quality, £3, 15s.; and of that of the inferior, less than £3, 3s. It would appear that there is in these grass-fields a certain quantity of grass that the cattle refuse to touch, which is cut for hay. This amounts, we understand, to about fifty imperial stones.

The following extract will show the estimated cost and quantity of food supplied to stall-fed cattle :—

Certain graziers altogether fatten, or finish off the fattening of oxen in the byre, upon the following food :—

1. With the best hay, in the proportion of twelve kilogrammes, or twenty-five pounds* per diem.

2. With barley-meal, of which they supply at least three kilogrammes, or seven pounds.

Others give to their beasts :—

1. Three or four oilcakes, equivalent to five or six kilogrammes, or from ten to thirteen pounds.

* Dutch.

2. Two bottles of hay, or from twenty-four to twenty-five pounds.

An ox in good condition, weighing from 275 to 300 kilogrammes, (550 to 600 pounds,) and requiring to weigh, when fat, 400 kilogrammes, will, placed in the byre during winter, fatten in seventy days, and nearly equal in quality to one fed upon grass.

The common price of hay is from twenty-five to thirty centimes. A centime is the hundredth part of a franc, the bottle of six kilogrammes (12 lb.); that of barley-meal is ten centimes the kilogramme, and that of oilcake twenty centimes for the same weight.

The management of milch cows and the dairy next receives the attention of M. Du Bois. We proceed to mark out some of his observations under this head, in the order that he puts them down. The following are considered the good points of a milch cow:—"A large belly; the interval between the last of her false ribs and the hip-bone considerable; the forehead large and open; the eye large and lively; the head well carried; compact jaws; the dewlap dependent; the shoulders fleshy; the legs stout, thick, and muscular; the hoofs little, thick, and of a blackish-red hue; the horns brown, and well set on; the ears long and hairy: the tail long, thick, and provided with an ample tuft at its end: the bag large, and displaying many large veins, and the teat thick, round, and long."

It is, he says, bad husbandry to allow a heifer to be served by the bull until she has completed her second year. A cow's natural term of life is considered to be twenty-five years; but it is considered advisable to fatten them at ten. The Normandy cow, which is, we suppose, the same, or nearly the same, as the breed we know as Alderneys, is considered one of the best dairy cows; but the French possess many other varieties. Among others, they have what they call the Holland cow, which we make no doubt is the same as the Teeswater. They have likewise a small but very excellent breed, that is derived from Switzerland. Du Bois compliments our English neighbours upon their breeds of dairy cows, and adds that there is in Scotland a race without horns, "that live in an almost savage state among the mountains and the rocks" of that country! From a dozen to fifteen cows are allotted in France to one servant. In summer they are milked thrice a day, but at other seasons only twice.

In Lausanne the cows kept confined to the stable yield annually 150 pounds (Dutch) of butter, and 300 pounds of white cheese In the Jura, they calculate that a cow yields, during the six months of green meat, 180 pounds of the celebrated Gruyère cheese. On the other hand, on the mountains of Auvergne, a cow only produces in the year 30 pounds of butter, and 150 of cheese. In the richer pastures of France, Du Bois states that if a cow calve at the commencement of May, the calf will consume the milk until the end of that month, and that, from this time to the end of July, she will yield twenty-four litres (six gallons) of milk a day; and that, from the end of July to the end of October, sixteen litres, (four gallons.) Among an arable farm, it is the rule to keep six dairy

cows for each plough, partly as a profitable means of disposing of a portion of the produce, and partly as supplying manure. Each of these cows is said to bring in annually about £4.

The custom of soiling milch cows appears to be a very common one in France. The particulars that require to be attended to when doing this are very clearly laid down: an extreme attention to cleanliness, good ventilation, frequently changed litter, cool air in summer, warmth in winter, a sufficient supply of wholesome food, with an occasional variety, and a little walk each time of being let out to drink, are among the principal. The root crops are all ordered to be washed and sliced. Taking hay as the standard of quantity, about twenty-four to thirty pounds are considered a sufficient daily allowance.

One of every ten female calves is annually to be kept, so as every year to be able to fatten one cow at the age of ten. Cows bred upon the farm, he thinks, do better than those purchased from without. Calves are not allowed to suck the mother, but are fed by hand, three times a-day, with newly-milked milk. At the age of a month and a half, a calf should weigh 90 pounds; and at the age of three months, 130. Their quantity of milk is gradually diminished after the expiration of six weeks, and its place taken by meal and water. At the end of three or four months they live entirely on the pasture.

A calf (we suppose at three months old) sells at from rather more than one to rather more than two guineas. A young ox at two years of age fetches from £5 to £8; and a female calf, if it have good points, sells for more than £2, when two months old. A calf, from the day of its birth to fifteen days old, is supposed to consume 6 litres (a gallon and a half) of milk a-day; for the next fifteen days, 8 litres (2 gallons) per day; and afterwards 10 litres, (2½ gallons.) In the neighbourhood of large towns, milk, we are told, sells for fifteen centimes the litre—that is, 7½d. a gallon; but in country places milk is very much cheaper.

It has, says our author, been ascertained by experiments, that the proportion of butter to a given quantity of milk varies according to the date of gestation of the cow, but that the average for all the year round is, for 12 litres of milk, a kilogramme of butter—that is, about 2 lb. (Dutch) of butter to every 3 gallons of milk.

The proper temperature, according to Du Bois, that the cream should be at when put into the churn, is 53° of our scale.

We have reason to believe that the following recipe for salting butter is a very good one:—Saltpetre, 1 part; sugar, 1do.; salt, 2 do. Of this two ounces are considered sufficient for a kilogramme (2 lb.)

Our lengthening pages, however, warn to come to a conclusion; and we need only now endeavour to compress in a short space the more striking of the French modes of managing other domesticated animals, including poultry, as described to us by M. Du Bois.

The native breeds of sheep in France are a small, semi-wild race.* The principal aim of French agriculturists desiring to improve them, seems to have been crossing with merinos. Towards the close of the last century, one of the conditions of the peace between the French and the Spaniards was, that the latter furnished a supply of this their favourite breed. Some of the merino rams have sold for very high prices—more, according to Du Bois, than £90 a-piece. Du Bois speaks as if the introduction of merino blood among the French flocks had been successful. As far as regards the management of sheep, our author insists upon their being housed in winter nights. Rams are not allowed to serve ewes until two years of age, and ewes not to have lambs until that age or more. The period of impregnation appears more extended than is our custom, and the season is stated to begin in May and end in October. He speaks of producing two lambings in the year as if it were a common practice. The female lambs destined for food have their ovaries removed. It is a custom, we are told, in some parts of France to amputate the tail, except about four fingers' breadth.

Like our own blackfaced sheep, those of France are not considered fit for food until at least three years of age, and they are sometimes kept until six. They do not in general attain much size. A Flemish breed which the French possess are put down as reaching from 60 to 80 lb., (the large pound,) Artois sheep as weighing from 40 to 50, while a breed much liked by the Parisian consumers, and called Alençons, only weigh from 26 to 32. The weight of the fleece also varies very much. That of the Flemish breed is put down at from 10 to 12 lb., while the lightest is marked 3 or 4.

The fattening of sheep under cover in winter seems a common practice. Those intended to be so treated are put up at the end of December. They are invariably shorn. They are, according to Du Bois, fed as follows:—In the morning each animal receives an allowance of 12 ounces of hay, and at night a similar quantity; at mid-day a pound of oats, and as much oilcake broke into pieces as the size of the little finger. Once a-day they have water. Towards the close of the fattening the cake is stopped, as it is believed to communicate an unpleasant savour to the flesh, and its place taken by either oats, barley, peas, or beans. Du Bois denies that sheep will fatten on turnips.

Many agriculturists have imported into France the Leicester sheep. It is known by the name of the "Dishley."

The French possess three main breeds of swine—the Norman,

* We may mention a trifling instance of this. While walking in the north of France, accompanied by a Dandie Dinmont terrier, we met a flock of sheep. The whole flock attacked the dog, who, as he dare not retaliate, had nothing for it but flight. The sheep, however, pursued, and we were obliged to call the dog to us and carry him away in our arms.

the Poiteven, and the Perigord—the two former large kinds, with long, pendant ears, but the latter a smaller black breed, with short, curled ears. Du Bois employs the boar for three years, beginning when he is a year or eighteen months old; but a common French plan is to castrate and fatten him at the age of eighteen, both because his flesh is thus considered to be better, and because the inconvenience of his becoming ferocious as he grows older is thus obviated. In choosing a sow, care is taken that she have sixteen teats. French sows seem even more productive than ours, and Du Bois tells a tale of one in Normandy that had, in four successive litters, twenty-four, twenty-eight, thirty, and thirty-two pigs. The French mode of managing pigs differs little from our own. We may remark that our neighbours, however, do not castrate any of their pigs until they are three months old, and that if they wish a very large animal, they delay the operation until the animals are from fifteen to eighteen months.

Du Bois' observations upon horses, asses, and mules, present nothing of interest to detain, and we shall conclude this paper with a very short account of the French mode of managing poultry. We are surprised to find Du Bois stating at the outset, that hens, save in frosts and snows, require no supplies of food. One cock is allotted to twenty hens, and both cocks and hens are allowed to live six or seven years. The favourite bird in France for hatching all kinds of eggs seems the turkey. She obtains this preference from her assiduity, and power of covering a number of eggs. The French are in the habit of making many capons. The operation must be performed before the month of July. To fatten them, they are supplied with abundance of corn and milk, and kept in a warm and darkened place. Turkeys are in like manner put up to fatten, and their usual weight, when fat, is set down at from 20 to 25 lb. Ducks are treated in like manner; and Du Bois maintains that a young duck may be made, at two months old, to weigh from 6 to 8 lb. His largest geese he estimates at from 16 to 18 lb., and he states that one will consume during its fattening about 50 lb. of corn—(oats or barley, we think, are referred to.) Du Bois suggests that the bustard might be added to our list of domesticated poultry. It certainly seems a pity that so fine a bird should be allowed to become extinct. Moreover, it is strange that no additions have been made to our domesticated animals in such an immense period of time. The earliest records of husbandry narrate the same, and as many, domesticated animals as we possess at the present day.

Observations of the Barometer and Thermometer at Edinburgh, for the Years 1847-51. By KENNETH M'KENZIE, Esq., Accountant, Edinburgh.—Having kept a journal of the height of the barometer and thermometer for several years past, I think it may prove not uninteresting to the readers of this Journal to give them

a few of the results I have arrived at, from my calculations of their average, and of their extreme height and depression.

In so far as the barometer is concerned, I may mention that I have ascertained that the room it is in stands about 170 feet above the sea-level; in regard to the thermometer, it of course stands in the shade. My markings have always been made at nine o'clock A.M., and I can vouch for their accuracy.

I subjoin, then, the markings for the years 1847-51, and intervening years; and I submit, in a tabular form, the average monthly, yearly, and general height. It is curious to contrast the averages with the occasional height or depression: for example, the average height of the barometer, during the month of December 1849, was 29.82, while the highest range was 30.79, (on the 22d,) and the lowest was 29.48, (on the 28th;) during the month of February 1850, the highest range was 30.22, (on the 26th,) the lowest was 28.54, (on the 6th,) while the average was 29.64.

I have instanced these two months, as in them are contained the examples of the greatest height and greatest depression, (30.79 and 28.54,) showing a variation during the five years of exactly two inches and a quarter.

With my tables before them, those of my readers who can spare time for the calculation will discover many remarkable instances of the sudden rise and fall of the barometer, and may be induced to attend to the subject more closely than my other occupations permit me to do. For instance, during a south-westerly gale, I have observed the barometer fall fully an inch; and, before the storm was at its height, suddenly rise as fast, and, by nine o'clock on the following morning, the height greater than it was previous to its rapid fall—probably with a keen north-west wind blowing, and light fleecy clouds scudding across the sky.

This shows that, to obtain actual correctness, the barometer should be marked several times instead of only once each day, and I should be glad to find that some party were inclined to adopt this practice.

And, if this remark applies to the barometer, it, of course, does so in a much greater degree to the thermometer. The highest marks, viz. 72°, occurred on 2d August 1850, and on 29th and 30th June 1851, while the lowest, viz. 20°, occurred on the 29th January 1848, showing a range of 52°. No doubt, previous to sunrise on the latter day the thermometer was lower, and, during the blaze of a summer's sun, higher than the marks just indicated. I think, however, of getting a self-registering instrument, by which actual results can be obtained.

My labours, then, if of any use, are heartily at any one's service; and, if they are the means of inducing some one more competent than I am to undertake the task more minutely, I shall be glad to compare my register with his, and forward him the results—or to calculate for him the averages over periods of months, quarters, or years.

1847.

Days.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Days.
	Bar.	Ther.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	
1	30.44	43°	29.83	35	30.49	40	29.36	38	29.68	46	30.51	63	30.39	62	29.84	71	29.48	57	30.21	53	29.99	56	29.91	41	1
2	30.19	41	30.07	35	30.59	40	29.36	40	29.68	49	30.49	69	30.35	63	29.86	62	29.79	55	30.27	50	30.07	52	29.89	50	2
3	29.84	38	30.08	33	30.63	42	29.51	41	29.85	48	30.41	66	30.16	63	29.90	59	29.78	54	30.27	50	30.35	46	29.85	45	3
4	29.76	38	30.12	34	30.57	41	29.56	41	29.93	47	30.40	59	30.03	61	29.76	58	29.73	52	30.14	49	30.15	48	29.50	43	4
5	29.81	42	29.95	41	30.50	44	29.44	46	29.90	48	30.30	57	29.90	58	29.46	63	29.78	51	29.88	46	29.86	51	29.00	38	5
6	29.96	45	29.43	44	30.36	42	29.67	46	29.75	50	30.13	57	29.86	62	29.58	60	29.72	53	29.76	50	29.75	55	28.57	38	6
7	30.05	46	29.52	31	30.20	43	29.59	49	29.69	48	30.00	57	29.74	58	29.48	62	29.80	56	29.42	51	29.54	54	28.91	39	7
8	30.12	45	29.50	25	30.18	45	29.06	51	29.52	47	29.67	56	29.81	64	29.34	56	29.85	56	29.55	50	29.23	57	29.34	32	8
9	30.30	36	29.28	28	30.06	36	29.31	45	29.41	51	29.86	58	29.85	68	29.60	59	29.75	61	29.85	51	29.54	50	28.95	50	9
10	30.23	32	29.54	31	30.05	33	29.75	46	29.79	57	29.66	57	29.96	65	29.65	61	30.00	56	29.65	55	29.86	53	29.61	43	10
11	30.12	33	29.74	33	29.94	37	29.80	47	29.71	50	29.90	60	29.98	73	29.89	61	29.99	53	29.79	59	30.03	48	29.43	43	11
12	30.03	35	29.78	30	30.06	40	29.58	53	29.58	56	29.86	58	30.10	71	29.72	64	29.52	58	29.92	54	30.20	42	29.70	45	12
13	29.90	34	29.84	33	30.05	44	29.96	44	29.69	59	29.54	58	30.17	72	30.18	62	29.67	53	30.09	51	30.04	49	29.76	45	13
14	29.91	36	29.35	40	30.06	45	30.15	43	29.63	60	29.36	62	30.20	70	30.42	58	29.75	50	30.00	47	30.10	51	29.89	45	14
15	29.93	41	29.25	41	29.85	48	30.06	47	29.73	60	29.33	50	30.17	67	30.39	58	29.74	53	29.97	52	29.97	56	29.73	47	15
16	30.04	40	29.36	42	29.58	52	29.95	50	29.70	46	29.58	57	30.15	56	30.29	58	28.81	52	30.07	52	30.04	42	29.62	48	16
17	30.14	37	29.45	43	29.59	53	29.64	43	29.70	42	29.62	55	30.15	61	30.11	61	29.14	53	29.83	52	30.20	39	29.38	48	17
18	30.12	38	29.37	49	29.74	53	29.91	49	30.00	48	29.83	52	30.07	63	30.21	60	29.29	48	29.51	56	30.37	35	29.30	47	18
19	30.16	36	29.50	40	29.59	48	29.62	47	29.66	55	29.86	63	29.96	67	30.12	59	29.67	51	29.21	57	30.18	48	29.29	41	19
20	30.02	36	29.97	43	29.26	50	29.71	44	29.59	58	29.79	62	29.94	63	29.82	65	29.49	48	29.50	47	30.10	48	29.85	41	20
21	29.89	36	30.01	46	29.34	51	29.93	49	29.88	59	29.53	57	29.84	61	29.72	58	29.92	49	29.58	46	29.60	49	29.73	40	21
22	29.75	36	30.23	44	29.79	45	30.06	47	29.72	58	29.48	62	29.71	63	29.25	59	29.79	61	29.63	54	29.44	45	29.82	38	22
23	29.61	38	30.28	38	29.71	48	29.96	45	29.88	57	29.47	60	30.14	63	30.05	53	29.52	61	29.37	49	29.28	41	29.87	39	23
24	29.17	40	30.20	35	29.72	42	29.89	50	29.59	62	29.41	62	30.13	63	30.15	61	30.05	54	29.39	45	29.55	45	30.00	37	24
25	28.95	39	30.16	36	29.99	43	29.88	50	29.70	55	29.47	63	30.02	62	30.01	61	29.70	60	29.82	44	29.61	52	30.34	40	25
26	29.00	45	30.21	39	29.98	44	29.32	54	29.96	62	29.88	60	29.95	64	30.17	63	30.22	47	30.16	48	29.59	42	30.38	41	26
27	28.89	43	30.24	36	29.94	45	29.07	52	30.00	59	30.13	65	30.01	61	30.14	66	30.26	46	29.95	55	29.39	39	30.29	34	27
28	28.83	41	30.34	39	29.78	39	29.10	50	29.89	56	30.31	70	29.87	60	30.23	62	30.33	54	30.23	46	29.00	36	30.28	34	28
29	29.12	38	...	...	29.77	44	29.38	50	29.72	54	30.39	63	29.97	65	30.19	59	30.38	51	30.00	52	29.14	38	29.87	38	29
30	29.52	40	...	...	29.70	41	29.54	49	30.15	63	30.41	65	29.91	67	29.83	61	30.37	54	30.07	49	29.32	51	29.72	36	30
31	29.73	33	...	...	29.54	41	...	...	30.46	66	...	...	29.91	63	29.83	61	...	...	30.02	49	...	...	29.97	28	31

1848.

Days.	January.		February.		March.		April.		May. *		June.		July.		August.		September.		October.		November.		December.		Days.
	Bar.	Ther.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	
1	29.76	32°	29.60	32	28.78	38	29.97	52	30.14	49	29.57	56	29.64	54	29.27	61	30.19	59	29.47	54	29.61	43	29.48	40	1
2	29.62	36	29.96	39	29.28	41	29.93	49	30.07	55	29.25	56	29.66	57	29.65	59	30.21	60	29.56	56	29.66	42	28.86	39	2
3	29.45	50	29.94	43	29.98	40	29.92	57	30.00	57	29.27	53	29.63	58	29.69	59	30.23	60	29.56	54	29.59	38	29.42	36	3
4	29.75	44	29.66	48	30.00	43	29.90	54	30.10	58	29.38	50	29.85	57	29.60	58	30.02	61	29.36	62	29.72	33	28.86	46	4
5	29.40	43	29.77	42	29.66	42	29.75	48	30.12	60	29.52	59	30.13	59	29.46	60	29.70	60	29.80	57	29.49	40	28.68	40	5
6	29.77	34	30.11	39	29.87	42	29.73	44	30.10	55	29.62	58	29.95	62	29.48	57	29.46	62	29.74	63	29.40	45	28.97	37	6
7	29.35	37	29.80	40	29.88	42	29.67	40	29.85	57	29.56	57	29.68	65	29.73	59	29.71	61	30.01	57	29.50	41	29.35	38	7
8	29.60	39	29.66	41	29.93	45	29.64	43	29.85	55	29.60	58	29.58	62	29.83	58	29.61	60	29.78	60	30.07	37	29.40	42	8
9	30.20	38	28.69	45	29.71	51	29.73	40	30.20	55	29.61	58	29.71	62	29.74	59	29.61	55	29.71	55	30.39	34	29.78	49	9
10	30.18	36	28.57	42	29.18	43	29.40	41	30.21	58	29.50	59	30.05	66	29.87	60	29.61	53	29.63	53	30.40	42	29.88	55	10
11	30.41	36	29.06	42	28.55	39	29.61	41	30.19	65	29.68	59	30.34	65	29.99	57	29.97	50	29.98	52	30.53	43	29.77	52	11
12	30.33	45	29.53	41	28.81	38	29.39	44	30.07	64	29.78	54	30.43	71	29.99	56	30.26	46	30.03	49	30.60	35	29.98	46	12
13	30.42	41	29.47	48	29.37	41	29.60	44	30.15	63	29.49	51	30.44	69	29.98	55	30.22	53	30.30	49	30.44	39	29.61	54	13
14	30.20	40	29.45	45	29.75	40	29.79	45	30.25	52	29.55	56	30.36	64	30.03	55	30.17	52	30.36	48	30.33	40	29.59	44	14
15	29.96	37	29.43	43	29.51	43	29.94	46	29.82	54	29.89	60	30.30	61	30.00	58	30.30	52	30.17	48	30.42	36	29.61	46	15
16	29.78	41	29.68	38	29.75	43	29.83	51	29.35	63	29.99	56	30.23	64	29.90	59	30.26	62	29.98	48	30.11	45	29.62	43	16
17	29.39	38	30.36	33	29.64	42	29.43	55	29.31	58	29.83	59	30.14	60	29.51	58	30.26	57	30.09	42	29.67	47	29.66	43	17
18	29.30	30	30.20	38	29.58	42	29.50	50	29.20	58	29.89	58	29.94	62	29.96	57	30.26	51	29.93	37	29.31	44	29.67	41	18
19	29.52	35	29.47	43	28.99	44	29.39	47	29.57	58	30.13	57	29.34	66	29.33	57	29.83	53	29.96	40	29.79	36	29.87	42	19
20	29.87	33	29.41	39	28.80	39	29.52	45	29.86	59	30.16	60	29.00	65	29.66	56	29.55	60	30.07	39	29.15	54	30.25	45	20
21	30.18	31	29.53	39	29.00	39	29.66	47	30.12	59	30.04	63	29.38	60	29.51	55	29.82	51	29.94	41	29.20	44	30.38	31	21
22	30.04	32	29.08	40	29.46	40	29.80	51	30.31	59	30.02	58	29.54	61	29.36	53	29.82	58	29.63	45	29.18	42	30.43	28	22
23	30.17	32	28.59	44	29.22	51	29.89	48	30.34	65	29.92	59	29.58	59	29.56	50	29.71	57	29.44	47	29.06	42	30.49	38	23
24	30.51	32	29.04	39	29.96	46	30.00	47	30.29	61	29.63	58	29.68	62	29.80	56	29.45	59	29.11	45	29.64	36	30.14	38	24
25	30.53	26	28.64	39	30.12	46	29.93	50	30.29	57	29.74	58	29.45	63	29.94	54	29.62	54	29.36	40	29.85	41	29.86	41	25
26	30.33	36	28.75	42	29.74	46	29.93	46	30.12	54	29.96	60	29.50	60	29.61	57	29.76	55	29.64	46	29.49	47	29.62	45	26
27	30.24	36	28.70	40	29.73	44	29.74	46	30.10	57	29.61	61	29.40	62	29.64	57	29.89	54	29.43	49	29.60	46	29.74	46	27
28	30.01	32	28.76	47	29.68	44	29.49	43	30.07	55	29.46	63	29.86	64	29.48	61	30.04	51	29.16	47	29.59	50	30.14	34	28
29	29.90	20	28.99	41	29.80	45	29.81	45	29.92	55	29.47	63	30.06	58	29.73	60	29.95	49	29.44	44	29.57	47	30.29	34	29
30	29.40	36	...	...	29.63	52	30.04	47	30.03	61	29.44	55	29.74	62	29.81	58	29.81	53	29.60	46	29.61	41	30.29	38	30
31	29.20	28	...	...	29.93	49	...	...	29.72	54	...	...	29.40	63	30.19	57	...	...	29.64	42	...	...	30.17	37	31

1849.

Days.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Days.
	Bar.	Ther.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	
1	30.27	37°	30.18	34	29.55	40	29.46	45	30.32	45	29.89	56	29.91	61	29.98	59	29.82	64	29.56	48	29.54	48	29.92	40	1
2	30.13	29	30.10	45	29.73	45	29.34	51	30.11	49	29.97	62	29.79	60	30.08	60	29.60	58	29.66	43	29.59	43	29.69	42	2
3	29.83	22	30.13	50	30.14	46	29.56	48	30.10	51	30.18	59	29.32	56	30.05	57	29.95	57	29 51	44	29.49	46	29.75	42	3
4	29.88	35	30.14	51	30.22	48	29.61	46	30.08	50	30.11	65	29.54	58	30.01	55	30.24	56	29.27	39	29.07	48	29.70	37	4
5	29.91	36	30.24	48	30.21	47	29.56	44	30.06	49	29.92	66	29.76	57	29.92	61	30.28	58	29.50	40	28.57	42	29.36	34	5
6	30.02	30	30.25	47	30.31	46	29.47	51	30.04	46	30.08	56	29.87	61	30.03	61	30.28	56	29.67	38	29.31	36	29.38	41	6
7	29.95	32	30.12	48	29.56	46	29.49	46	30.18	47	30.20	56	29.80	61	30.03	56	30.32	51	29.67	43	29.81	37	29.68	43	7
8	29.44	38	29.70	44	29.80	36	29.65	41	30.25	51	30.11	50	29.85	63	29.83	62	30.20	53	29.86	44	29.94	43	29.52	43	8
9	29.36	39	30.14	44	29.91	35	29.89	42	30 09	50	30.04	53	30.17	62	29.75	67	29.64	55	29.86	45	30 01	54	29.83	45	9
10	28.53	43	29.94	47	30.30	34	29.90	42	30.00	49	29.83	52	30.30	64	29.70	60	29.49	55	29.86	41	30.00	55	30.12	45	10
11	29.50	35	30.63	42	30.08	42	29.86	40	30.00	51	29.88	55	30.37	68	29.72	61	29.11	54	29.75	41	29.97	56	30.31	40	11
12	29.77	39	30.62	39	30.00	48	29.66	46	30.17	52	29.88	49	30.42	58	29.48	65	29.02	56	29.86	43	29.83	56	30.17	41	12
13	29.41	43	30.31	45	30.09	44	29.20	43	29.85	53	30.07	51	30.36	60	29.18	64	29.43	54	30.03	42	29.58	51	29.87	39	13
14	29.11	39	30.35	46	30.22	45	29.41	44	29.55	54	30.08	54	30.29	60	29.29	62	29.82	59	30.27	44	29.37	44	29.53	44	14
15	29.60	43	30.33	49	30.25	52	29.88	42	29.45	49	30.00	57	30.22	61	29.56	61	29.95	62	30.28	36	29.50	39	29.66	45	15
16	29.70	45	30.34	46	30.31	46	29.70	50	29.38	50	29.90	59	30.12	58	29.54	54	30.08	53	30.07	45	30.03	42	29.53	49	16
17	29.35	46	30.38	46	30.24	47	29.74	34	29.15	52	29.96	54	29.62	68	29.74	59	30.39	51	29.60	48	30.18	42	29.33	45	17
18	29.39	48	30.10	49	30.09	50	29.81	42	29.30	61	29.94	62	29.55	61	29.96	54	30.42	49	29.74	58	29.79	54	29.42	46	18
19	29.65	44	29.50	52	29.98	43	29.61	39	29.91	50	29.51	55	29.42	59	30.08	60	30.46	56	29.82	62	30.00	48	30.04	42	19
20	30.07	35	29.60	41	30.09	46	29.80	39	29.83	49	30.04	55	29.53	64	30.15	60	30.53	59	29.63	53	30.02	49	30.39	36	20
21	29.66	50	29.81	38	30.24	49	29.83	41	29.71	56	29.85	58	29.76	60	30.18	64	30.55	54	29.54	52	29.95	50	30.64	40	21
22	29.50	40	29.35	44	30.19	41	29.85	44	29.51	57	30.05	60	29.83	61	30.00	63	30.39	54	29.93	46	29.77	47	30.79	38	22
23	29.82	47	29.77	38	30.16	43	29.59	44	29.76	58	29.77	57	29.54	66	30.10	58	30.17	56	29.81	53	29.34	46	30.72	32	23
24	29.77	49	29.46	37	30.05	45	29.65	48	30.07	62	29.86	61	29.46	61	30.16	56	30.02	56	29.92	48	29.25	40	30.56	41	24
25	29.52	51	29.44	37	30.08	42	29.55	49	29.81	57	29.91	59	29.37	54	29.96	65	29.94	54	29.68	58	29.33	37	30.58	38	25
26	29.37	38	29.68	33	29.99	44	29.59	50	29.72	61	29.77	64	29 44	62	29.84	62	30.00	56	29.53	53	29.87	37	30.11	42	26
27	29.74	38	29.92	33	29.49	44	29.58	52	30.00	58	29.76	60	29.75	63	29.79	58	29.97	57	29.74	50	30.16	37	29.51	37	27
28	29.23	39	28.91	40	29.58	42	29.55	52	30.24	59	29.96	58	29.84	62	29.84	60	29.87	58	30.23	50	30.00	31	29.48	25	28
29	29.95	36	...	...	29.55	39	30.05	53	30.16	65	30.00	61	29.63	62	29.84	63	29.54	56	30.45	51	29.70	35	29.64	37	29
30	29.66	40	...	...	29.31	43	30.27	60	30.06	59	30.12	60	29.43	62	29.82	63	29.42	49	29.95	54	29.63	43	30.16	34	30
31	29.90	38	...	...	29.39	46	...	...	29.93	58	...	...	29.62	60	29.79	62	...	...	29.54	47	...	...	30.30	32	31

1850.

Days.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Days.
	Bar.	Ther.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	
1	30.20	37°	29.37	48	29.96	49	29.48	50	30.21	49	30.27	53	29.51	60	30.19	63	30.24	61	29.46	51	29.62	56	30.04	38	1
2	30.10	43	29.40	46	29.94	52	29.13	47	30.21	48	30.33	69	29.60	61	29.94	72	30.24	61	29.78	50	29.60	53	29.98	42	2
3	29.67	46	29.40	42	29.44	48	29.10	53	30.06	53	30.33	65	29.15	65	29.96	66	30.14	59	29.79	50	29.78	50	29.94	48	3
4	29.43	40	29.74	39	30.08	39	28.76	53	29.85	49	30.19	66	29.60	63	29.51	66	30.36	52	29.74	55	29.31	44	29.80	49	4
5	29.17	35	29.39	38	30.16	47	29.27	53	29.66	42	29.88	60	29.83	59	29.62	64	30.32	53	29.61	48	29.48	49	29.94	53	5
6	29.44	30	28.54	40	30.30	50	29.76	49	29.80	42	29.51	61	30.03	59	29.66	61	30.38	52	29.52	49	29.80	47	30.27	53	6
7	29.91	32	29.23	36	30.38	51	29.33	53	29.73	46	29.24	63	29.92	60	29.80	58	30.48	54	28.86	51	29.70	52	30.28	42	7
8	30.27	29	29.32	38	30.37	46	29.40	54	29.42	49	29.72	61	29.98	59	29.52	68	30.48	54	29.45	52	29.60	44	30.25	38	8
9	30.16	29	28.89	49	30.10	47	29.15	49	29.80	40	30.01	62	29.94	57	29.35	64	30.37	50	29.86	48	30.11	45	30.31	36	9
10	29.98	32	29.69	36	30.06	47	29.17	53	29.50	49	29.96	58	30.02	58	29.65	65	30.31	51	30.02	45	29.88	55	30.13	36	10
11	29.75	34	29.50	40	30.46	42	29.44	48	29.67	53	29.66	62	30.00	64	29.54	63	30.25	57	30.19	44	29.82	55	29.77	48	11
12	30.07	36	29.10	37	30.50	42	29.74	47	29.66	50	29.50	57	30.06	63	29.81	60	30.25	52	30.39	40	29.95	45	29.67	45	12
13	30.14	36	29.90	32	30.47	43	29.83	46	30.14	51	29.26	62	30.09	68	29.93	64	30.31	52	30.14	50	30.01	42	29.56	46	13
14	29.98	33	29.60	44	30.54	49	29.86	48	29.93	52	29.52	53	30.19	62	30.07	67	30.31	54	29.72	53	30.20	33	29.35	41	14
15	29.78	29	29.58	52	30.50	45	29.49	45	30.03	46	29.70	53	30.10	59	30.09	65	30.34	55	29.90	42	30.14	39	28.93	40	15
16	29.55	34	29.67	41	30.35	47	29.04	45	29.85	52	29.95	55	30.02	63	30.03	59	30.37	52	29.73	53	29.80	50	28.79	42	16
17	29.85	25	29.90	47	30.28	43	29.20	51	29.89	58	29.98	59	29.94	62	29.98	58	30.34	49	29.70	53	29.86	43	28.90	40	17
18	29.82	33	29.86	51	30.28	43	29.71	52	29.68	57	30.17	59	29.95	60	29.66	60	30.03	54	29.88	54	29.72	45	29.33	33	18
19	29.49	35	29.70	51	30.19	49	29.60	53	29.77	54	30.26	65	29.96	57	29.26	57	29.78	56	29.75	53	28.65	48	29.55	36	19
20	30.14	35	29.71	46	30.22	43	29.33	47	29.96	53	30.14	66	29.93	65	29.47	54	29.62	54	30.00	46	28.90	47	30.10	34	20
21	30.19	30	29.60	48	30.30	44	29.65	52	29.88	50	29.95	62	29.86	68	29.51	51	29.30	55	30.19	44	29.57	42	29.88	47	21
22	30.27	39	30.06	50	29.98	45	29.96	48	29.60	54	29.88	65	29.88	68	29.48	54	29.67	55	30.07	43	29.44	46	30.30	42	22
23	30.25	44	30.11	47	29.57	39	30.03	46	29.56	50	30.12	63	29.94	67	29.69	55	29.82	56	29.32	44	29.05	48	30.35	45	23
24	30.18	44	30.18	46	29.75	35	30.08	46	29.54	53	30.19	69	29.78	59	29.88	52	29.82	55	29.41	43	28.69	50	30.25	47	24
25	29.70	41	30.20	46	29.71	31	30.00	49	29.36	49	30.19	63	29.80	64	29.47	58	29.69	53	29.68	44	28.62	44	29.68	39	25
26	29.44	36	30.22	45	29.72	36	30.27	47	29.25	57	30.00	58	29.70	62	29.56	56	29.57	56	29.78	38	29.29	43	29.97	48	26
27	30.35	27	30.10	51	29.84	36	30.34	50	29.48	60	30.11	59	29.82	62	29.92	56	29.53	55	29.72	43	29.88	35	29.98	49	27
28	29.50	46	30.09	48	29.98	35	30.40	49	29.73	59	29.87	62	30.04	61	29.93	53	29.35	53	29.28	40	30.20	29	29.98	42	28
29	29.94	37	...	...	30.00	39	30.47	48	30.06	68	29.56	58	30.18	63	30.01	57	29.52	50	29.42	39	30.18	36	29.98	45	29
30	30.14	37	...	...	29.85	41	30.36	48	30.06	62	29.64	58	30.16	69	30.18	53	29.23	49	29.30	50	30.14	33	29.70	49	30
31	29.98	39	...	...	29.51	42	...	...	30.18	51	...	...	30.07	68	30.16	57	...	...	29.70	49	...	...	29.50	44	31

1851.

Days.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Days.
	Bar.	Ther.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	B.	T.	
1	29.23	49°	29.52	41	30.30	40	30.03	48	29.60	50	30.33	63	30.07	66	29.72	65	30.06	66	29.08	54	29.34	41	30.36	35	1
2	29.40	45	29.66	39	30.44	39	29.83	45	29.82	49	30.04	61	30.15	60	29.90	62	30.05	62	29.08	51	29.18	39	30.24	32	2
3	29.97	38	29.21	42	30.10	42	30.08	48	29.85	46	29.55	59	30.24	53	29.76	67	30.14	66	29.40	55	29.78	37	30.24	32	3
4	29.79	36	29.68	35	29.93	44	30.22	46	29.84	47	29.73	49	30.09	59	30.11	59	80.15	61	29.22	53	29.94	34	30.14	41	4
5	29.40	45	29.25	48	29.62	49	30.02	44	29.87	46	29.55	46	29.95	59	30.36	59	30.29	56	29.22	52	29.97	42	29.99	49	5
6	29.60	40	29.44	39	29.85	42	30.02	45	29.87	50	29.55	51	29.95	60	30.34	57	30.46	52	29.43	47	29.96	44	29.92	50	6
7	29.47	32	29.56	47	29.90	39	30.08	46	29.72	51	29.84	59	29.92	67	30.30	57	30.57	55	29.18	56	30.00	43	29.83	50	7
8	29.35	40	29.70	43	29.90	47	30.22	43	29.57	53	29.53	54	29.74	60	30.24	57	30.56	56	29.62	49	29.84	48	29.27	45	8
9	29.55	39	30.30	43	29.56	45	30.03	45	29.63	56	29.58	57	29.73	59	30.12	58	30.47	52	29.74	50	29.86	47	29.75	52	9
10	29.66	43	30.21	49	29.64	41	30.04	44	29.76	58	29.66	51	29.74	53	30.12	57	30.47	53	29.81	55	29.66	44	29.54	55	10
11	29.76	53	30.09	49	29.97	38	30.07	46	29.96	49	29.79	56	29.96	60	30.07	59	30.43	56	29.85	60	30.16	48	30.19	48	11
12	29.55	47	29.99	44	29.55	42	30.02	48	30.12	52	29.51	51	29.81	64	29.98	65	30.38	54	30.12	51	30.27	42	30.40	44	12
13	29.38	50	30.06	38	29.60	40	30.08	47	30.32	50	29.71	53	29.52	58	29.82	65	30.32	54	29.68	59	30.35	47	30 47	41	13
14	29.30	46	30.04	45	29.64	43	30.06	47	30.37	54	29.93	56	28.87	60	29.70	68	30.36	60	29.67	52	30.42	39	30.52	40	14
15	29.07	45	30.08	46	29.68	44	29.95	45	30.17	58	29.77	59	29.44	59	29.77	63	30.54	53	29.11	50	29.98	40	30.35	45	15
16	29.41	41	30.17	45	29.88	43	29.89	47	29.97	56	29.42	58	29.69	59	29.96	60	30.60	52	29.31	44	29.92	40	30.15	51	16
17	29.15	42	29.76	45	29.74	42	29.73	47	29.88	58	30.04	57	29.84	57	29.83	52	30.55	51	29.71	44	29.92	34	30.22	49	17
18	29.69	40	29.49	48	29.48	43	29.66	55	29.61	55	30.19	57	29.84	59	30.17	58	30.38	53	29.59	54	29.94	33	29.95	45	18
19	29.73	48	29.36	54	29.35	46	29.78	50	29.60	52	29.82	59	29.86	60	30.16	64	30.15	52	29.70	54	29.76	37	29.93	43	19
20	29.41	48	29.54	43	29.26	46	29.68	53	30.06	54	30.00	60	29.56	57	30.13	62	30.10	58	30.00	49	30.00	36	29.75	49	20
21	29.15	41	29.82	39	29.14	48	29.28	54	30.10	64	29.81	66	29.70	58	29.81	65	30.09	55	29.97	58	29.88	43	29.46	46	21
22	29.40	40	29.96	36	28.98	48	29.22	55	30.07	60	29.69	61	30.01	58	29.80	65	29.94	60	29.98	58	30.19	40	29.63	38	22
23	30.12	41	29.92	37	29.02	45	29.58	49	30.24	57	30.09	59	29.82	63	29.65	63	30.12	60	30.25	54	29.90	41	30.16	36	23
24	30.05	46	29.86	40	29.50	45	29.81	51	30.30	56	30.14	61	29.66	62	29.60	59	30.09	57	30.37	51	29.37	38	30.23	32	24
25	29.77	41	30.00	43	29.70	46	29.92	51	30.01	55	30.06	63	29.58	58	29.87	55	29.69	50	30.37	51	29.40	35	30.24	41	25
26	29.65	43	30.46	39	29.32	45	29.81	44	29.95	57	30.06	67	29.58	60	29.65	61	29.66	44	30.15	53	29.75	40	30.42	42	26
27	29.57	40	30.42	39	29.25	45	29.69	46	30.00	55	30.19	64	29.74	59	29.62	60	29.58	49	30.08	53	29.86	38	30.51	41	27
28	29.53	43	30.42	37	29.35	45	29.54	39	30.18	58	30.17	62	29.55	64	29.64	55	29.84	48	29.57	51	30.04	36	30.55	43	28
29	29.22	50	...	...	29.30	43	29.55	45	30.34	64	30.17	72	29.70	63	29.76	53	29.65	50	29.40	47	30.08	37	30.47	39	29
30	29.16	38	...	...	29.40	45	29.65	48	30.39	64	30.17	72	30.04	55	30.16	55	29.21	56	29.80	44	30.17	38	30.30	47	30
31	29.11	36	...	...	30.03	45	...	...	30.47	59	...	...	29.73	59°	30.08	58	...	...	29.60	43	...	...	30.07	46	31

MONTHLY AND YEARLY AVERAGES.

THERMOMETER.

Months.	1847.	1848.	1849.	1850.	1851.	Mean monthly temp.
January, .	38°.7	35°.6	39°.5	35°.6	42°.8	38°.4
February, .	37.3	41.1	43.3	44.1	42.6	41.7
March, .	43.9	43.2	44.0	43.4	43.7	43.6
April, . .	46.9	46.9	45.6	49.3	47.4	47.2
May, . .	54.2	57.7	53.5	51.8	54.6	54.4
June, . .	60.2	57.7	57.5	60.9	58.8	59.0
July, . .	63.9	62.0	61.2	62.4	59.6	61.8
August, .	60.7	57.3	60.5	59.9	60.2	59.7
September,	53.6	55.6	55.5	54.0	55.0	54.7
October, .	50.6	48.9	47.2	47.3	51.7	49.1
November,	47.4	41.7	44.6	45.1	40.0	43.8
December,	41.2	41.5	39.9	42.5	43.6	41.7
Mean yearly temperature,	49.9	49.1	49.3	49.7	50.0	
Average temperature over the whole five years,						49°.6

BAROMETER.

Months.	1847.	1848.	1849.	1850.	1851.	Mean monthly height.
January, .	29.79	29.90	29.64	29.90	29.50	29.75
February, .	29.81	29.38	29.98	29.64	29.85	29.73
March, .	29.96	29.53	29.97	30.09	29.62	29.83
April, . .	29.63	29.73	29.67	29.65	29.85	29.71
May, . .	29.78	29.99	29.90	29.79	29.99	29.89
June, . .	29.89	29.69	29.95	29.90	29.87	29.86
July, . .	30.01	29.81	29.80	29.91	29.77	29.86
August, .	29.91	29.72	29.85	29.77	29.94	29.84
September,	29.78	29.91	29.96	30.01	30.16	29.96
October, .	29.84	29.74	29.80	29.72	29.68	29.76
November,	29.78	29.77	29.69	29.63	29.89	29.75
December,	29.67	29.74	29.92	29.82	30.10	29.85
Mean yearly height, .	29.82	29.74	29.84	29.82	29.85	
Average height over the whole five years,						29.81

Agricultural Chemistry—The Mineral Theory. By Mr Towers.—In looking over part i., vol. xii., of the *Royal Agricultural Journal*, lately published, my attention was particularly called to the four following articles which appear to contain matters of deep import, involving nearly all that is known, or even conjectured, of the value and utility of pure chemistry to practical agriculture. The articles I refer to are, 1st, "On Agricultural Chemistry," p. 1-40; 2d, "Experiment on the Growth of Wheat," p. 133–9; 3d, "On Nitrate of Soda for Wheat," p. 202–4; and, 4th, "On Superphosphate of Lime," by Mr Way, p. 204–235. When Liebig produced his *Chemistry of Agriculture* in the year 1840, he took, as it were, the world by storm; for although the lectures of Davy were known to the then few scientific agriculturists—and were by Liebig himself assumed as his leader and guide—for he said in plain words, "I have endeavoured to follow the path marked out by Sir H. Davy"—yet the principles enunciated by the great German analyst differed substantially in system and method from those of his assumed prototype. The following lines will suffice to elucidate the bearing of those principles:—"The object of organic chemistry is to discover the *chemical* conditions essential to the life and perfect development of animals and vegetables, and generally to investigate all those processes of organic nature, which are due to the operation of *chemical laws*." "A beautiful connection subsists between the organic and inorganic kingdoms of nature. *Inorganic* matter affords food to plants; and they, on the other hand, yield the means of subsistence to animals."—(*Organic Chemistry*, p. 1.)

The *mineral* inorganic hypothesis of Liebig, founded, as indeed it was, upon the assumption that, by trustworthy investigation of *the ashes of plants*, a correct idea might be formed of the substances which they had absorbed from the soil, appeared not only plausible, but strictly rational; hence it was favourably received, and was promulgated by many professors of chemistry who delivered lectures throughout the provinces.

The first person, I believe, who ventured to criticise the theory, was a chemical philosopher of great intellectual acumen—a young physician then residing in Scotland, who wrote several articles in the *Quarterly Journal of Agriculture*. They who can refer to that work in its original form, (about the years 1838–41,) may derive much satisfaction from the perusal of every paper which bore the name of Henry Madden, M.D. Circumstances to which it would be irrelevant to allude, withdrew that promising young philosopher from Scotland, and led him to Germany in pursuit of other objects of more general importance than agricultural chemistry. Subsequent to the period when Dr Madden gave publicity to his critical remarks, the *Mineral Theory* of Liebig has met with

serious opposition; in proof of which, to say nothing of foreign antagonism, we have only to refer to experiments conducted by Messrs Lawes and Gilbert, during the years 1844 to 1850, inclusive, with persevering energy.

As it appears of the utmost consequence to pursue the inquiry in research of truth, and also to induce others who are skilled in chemical analysis to be on the alert, I must take the liberty to extract some passages from the above-cited article, No. 1. "In the course of this inquiry," say Messrs Lawes and Gilbert,—"the whole tenor of our results, and also of information derived from intelligent agricultural friends upon every variety of land in Great Britain, has forced upon us opinions different from those of Professor Liebig on some important points; and more especially in relation to his so-called *Mineral Theory*, which is embodied in the following sentence, to be found at page 211, third edition of his work, on agricultural chemistry, where he says—'The crops on a *field diminish or increase in exact proportion to the diminution or increase of the mineral substances conveyed to it in manure.*'"

Before I proceed, it will be desirable to place before the reader the exact antagonistic positions assumed by the contending parties: these can be defined in the three words—*Minerals* versus *Ammonia.*

Liebig's theory will best be explained by the following extract from page 210 of his fourth edition:—"It is quite certain that in our fields the amount of nitrogen in the crops is not at all in proportion to the quantity supplied in the manure, and that the soil cannot be exhausted by the exportation of products containing nitrogen, (unless these products contain at the same time a large amount of mineral ingredients,) because the nitrogen of vegetation is furnished by the *atmosphere*, and *not by the soil.* Hence, also, we cannot augment the fertility of our fields, or their powers of production, by supplying them with manures rich in nitrogen, or with ammoniacal salts alone." Then follow the few lines already quoted, after which—"The formation of the constituents of the blood, and of the vegetable substances containing nitrogen existing in cultivated plants, depends upon the presence of certain substances contained in the soil. When these ingredients are absent, nitrogen will not be assimilated, however abundantly it may be supplied. The ammonia of animal excrements exerts a favourable influence, only because it is accompanied by other substances necessary for its conversion into the constituents of blood. When these conditions are furnished with ammonia, the latter becomes assimilated; but when the ammonia is absent from the manure, the plants extract their nitrogen from the ammonia of the air, to which it is again restored by the decay and putrefaction of dead animals and vegetable remains."

Of the vast importance attached to this theory by the author of it, we may form some faint idea; for in the new edition of his *Letters*, he tells the agriculturists of Britain that "sooner or later they must see that 'in this mineral theory,' in its development and ultimate perfection, *lies the whole* future of agriculture."

Thus Professor Liebig throws down the gauntlet of defiance, which, at this very point, is taken up by Messrs Lawes and Gilbert; but in order to do justice to the course of their experiments, as opposed to the mineral theory, it will be necessary to quote pretty freely from the article on agricultural chemistry,—so much so, at least, as to convey a clear idea of the *modus operandi* upon which their inductions are founded. Renouncing as inadequate the quantitative analysis of soils—(see *Royal Agricultural Journal*, p. 3)—our experimenters attempted to produce *exhaustion* in a certain quantity of land by a *complete rotation of crops*. Thus at page 4 they say—"On carefully considering established and well-known facts, it appeared to us that, by taking soil either at the end of the rotation, or at least at that period of it when, in the ordinary course of farming, farmyard manure would be added before any further crop would be grown, we should have the soils in what may be termed a *normal*, or, perhaps, better still, a *practically* and *agriculturally exhausted state*. Now, if it is found in the experience of the farmer, that land of any given quality with which he is well acquainted, will not, when in this condition of *practical exhaustion*, yield the quantity he usually obtains from it of any particular crop, but that after applying farmyard manure it will do so, it is evident that if we supply to different plots of this *exhausted* land the constituents of farmyard manures, both individually and combined—and if by the side of those plots we also grow the crop both without manure of any kind, and with farmyard manure—we shall have obtained in the comparative results a far more satisfactory solution as to what constituents were in this ordinary course of agriculture most in defect, in respect to the production of the particular crop experimented upon, than any analysis of the soil could have given us."

Here then, and so far, I think that every impartial reader will acknowledge, that Messrs Lawes and Gilbert have made a fair *exposé* of their plan; and now I proceed to cite just so many passages from their article as may suffice, without trespassing too far, to enable the practical reader to comprehend the precise way in which the needful experiments were carried out. To commence at page 5, par. 4—"In this way 14 acres have been devoted to the continuous growth of *wheat* since 1843; 8 acres to the continuous growth of *turnips* from the same date, and 5 to 6 acres to that of leguminous corn crops since 1847. Besides these, we have made other field experiments, amounting in each year to 30 or 40

on wheat, upwards of 90 on turnips, and 20 to 30 on beans; and also some on the growth of clover, and some in relation to the chemical circumstances involved in an actual course of rotation, comprising turnips, barley, clover and wheat, grown in the order in which they are here stated."

It would be superfluous to introduce here any remarks on the processes now pending, which are alluded to (prospectively as to the objects in view) at p. 6. But as to the cereal crops—that of *wheat* in particular—much remains to be said; because, as the writers tell us, that "in reference to the production of wheat, *the mineral theory of Liebig is more prominently at fault than* in that of any other."

The inorganic mineral constituents of a plant are found in the ashes which remain when any individual has been burnt; and a plausible theory was built upon such results; for it was a self-evident fact that whatever remained after the action of fire, must have previously resided in the organism; but, nevertheless, the theory involved errors, inasmuch as a considerable loss by sublimation must have been sustained, independent of the great electro-chemical changes which attend every process of incineration. Chemists appear to lose sight of the vital principle; and as every product of organic analysis is involved in the destruction of a body that had once been endued with life, but remains beyond the reach of any attempt to restore its form, or recombine its ingredients, they ought to be extremely cautious before they attempt to establish thereon any hypothesis. A case much to the point will soon be brought before the reader.

Baron Liebig contended that the presence of mineral substances in the land was required, in order to induce the due fertilising agency of ammonia. Mr Lawes admits that such mineral ingredients will aid in developing the accumulation of "vegetable or atmospheric constituent, when applied to some crops of the rotation; and it is *thus* that these crops become subservient to the growth of the cereal grains." The presence of azote (nitrogen) in atmospheric ammonia, and also in all animal and many vegetable manures, cannot be doubted; but is it not equally certain that land of a quality fitting the production of grain is always an unfailing magazine of mineral elements? Be this as it may, let us now apply the question to the following plain statements, and Table, extracted from pp. 7 and 8 of Lawes' and Gilbert's article.

"In the first experimental season, the field of 14 acres was divided into about 20 plots, and it was by the *mineral theory* that we were mainly guided in the selection of manures: mineral matters were therefore employed in the majority of cases. *Ammonia*, on the other hand, being then considered of less importance, was used in a few instances only, and in very insignificant

quantities." The results of the first season (1844) are then concisely given in the annexed Table—the ground, be it remembered, having been exhausted, in the ordinary acceptation of the word, by the course of cropping previously described.

TABLE I.—Harvest 1844. Wheat.

Description of the Manures.	Dressed Corn per acre in bushels and pecks.		Total Corn in lb. per acre.	Straw in lb. per acre.
	bush.	pecks.	lb.	lb.
Plot 3. Unmanured, ...	16	0	923	1120
„ 2. 14 tons of farmyard manure, . .	22	0	1276	1476
„ 4. The *ashes* of 14 tons of this manure, .	16	0	888	1104
„ 8. *Minimum* produce of 9 plots with artificial mineral manures—viz. Superphosphate of lime, 350 lb., Phosphate of potass, . 364 lb.,	10	1	980	1160
„ 15. *Maximum* produce of 9 plots with artificial manures:— Superphosphate of lime, 350 lb., Phosphate magnesia, 168 lb., Phosphate of potass, 150 lb., Silicate of potass, 112 lb.,	17	3¼	1096	1240
Mean of the 9 plots with artificial mineral manures, ...	16	3¾	1009	1155
Mean of 3 plots with mineral manures, and 65 lb. each of sulphate of ammonia, .	21	0	1275	1423
Mean of 2 plots with mineral manures, and 150 and 300 lb. of rape cake respectively,	18	1¾	1098	1201
Plot 18. With complex mineral manure, 65 lb. of sulphate of ammonia, and 150 lb. of rape cake, . .	22	3¼	1368	1768

Messrs Lawes' & Co. observe that the indications of the foregoing Table are conclusive; and certainly, so far as the failure of the *ashes*—that is, the *mineral* ingredients of 14 tons of farmyard manure—may bear upon their position, these gentlemen have triumphed. "If," say they, "the exhaustion had been connected with a deficiency of mineral constituents, we might have expected that by some one at least of the nine mineral conditions—supplying, in some cases, an abundance of every mineral constituent which the plant could require—this deficiency would have been made up; but it was not so.

Before I notice the plausible inductions which may apparently offer themselves from a comparison of the above several results, it will be necessary to call the reader's marked attention to a second Table, which contains certain products of the following year, 1845, under dressed corn; and these are important.

TABLE II.

Description of Manures.	Dressed Corn per acre.		Total Corn.	Straw.
	bush.	pecks.	lb.	lb.
Plot 3. No manure, ...	23	0¾	1441	2712
„ 2. 14 tons of farmyard manure, . .	32	0½	1967	3915
SECTION 2.				
„ 5 *a*. No manure, ...	22	2¼	1431	2684
„ 5 *b*. Top-dressed with 252 lb. of carbonate of ammonia, dissolved at three times during the Spring, .	26	3¾	1732	3599
SECTION 3.				
„ 9. Sulphate of ammonia 168 lb. Muriate of ammonia 168 lb. } top-dressed at once,	33	1½	2131	4053
„ 10. Sulphate of ammonia 168 lb. Muriate of ammonia 168 lb. } top-dressed at 4 times,	31	3¼	1980	4266

Comparing the quantities of corn produced in the years 1844 and 1845, as recorded in the foregoing tables, the reader must remark the excess of the latter season in every particular item. Thus, for instance, while the plot 3, *unmanured*, gave only 16 bushels in 1844, under a precisely similar condition it yielded 23 bushels—that is to say, more than 7 bushels—in advance of the harvest of 1845. "In like manner the farmyard manure gave 32 bushels in 1845, and only 22 in 1844." So say the writers—adding, that in a former article they had shown "how those differences can be traced to variations in the climatic character of the *season*." It would be interesting to compare the meteorological tables of the two seasons. I hope, and believe, that in the articles, CHARACTERISTICS, which were published by this journal, might now be traced a fair compendium of the weather which prevailed during each of those years—at all events, in and around Berkshire, a county not remote on one side from the locality of Rothampstead, Herts.

So far as memory may serve, the weather of 1844 was dry and hot, particularly arid in April, May, and June; whereas that of the following year had undergone a complete change: it was moist, and frequently wet, and, at the harvest, more or less showery. Now, if it be true that rain-water contains much *carbonate of ammonia*, we find a clue to guide our inquiries, and one which presents itself opportunely, inasmuch as Messrs Lawes and Gilbert lay great stress upon the fertilising agency of ammoniacal salts, as opposed to the inorganic theory of Liebig.

However, before offering any further remarks, I would trespass once more, by extracting the following portions of TABLE III:—

TABLE III.—Harvest 1846.—*Selected Results.*

Description and Quantities of Manures per acre.	Dressed corn per acre in bushels and pecks.		Total corn per acre in lb.	Straw per acre in lb.
	bush.	pecks.	lb.	lb.
Plot 3. No manure, ...	17	3¾	1207	1513
" 2. 14 tons of farmyard manure, .	27	0¾	1826	2456
" 10.*b* No Manure, ...	17	2¼	1216	1455
" 10.*a* Sulphate of ammonia, 224 lb. .	27	1¼	1850	2244
" 5.*a*[1] *Ash* of 3 loads of wheat straw, .	19	0½	...	1541
" 5.*a*[2] Ash of do. do. and top-dressed with 224 lb. of sulphate of ammonia, . . .	27	0	...	2309

Now, as to the season of 1846, the spring was, upon the whole, dry, with alternations of copious rains. The summer became hot and dry, but was visited by tremendous thunder-storms—one particularly, attended with hail, which destroyed thousands of window-glasses in and about London. Harvest was nearly ready, but had not generally commenced. This also was the second year of the potato blight. The latter summer proved extremely dry, the first supply of rain occurring about the close of September. October, on the contrary, was rainy to an extent that has made it remarkable for the great depth of rain which fell during its course. The observant reader, especially if he be a practical agriculturist, may, from the foregoing data, be able to arrive at something like a correct idea of the position of the two parties. The efficiency of the several ammoniacal salts appears to be proved, at least locally; and so far the inorganic theory of the German chemist has met with a repulse. But there are other points of great interest which will suggest themselves to the mind of the philosophic cultivator, and can, I think, be shown too important to be overlooked by him. They embrace the *seasons* as to meteorology, *soils*, and subsoils, in all their varieties; and, above all, as linked with these, the play of *chemico*-electrical agencies, resulting, as an inevitable consequence, from the decompositions and combinations of every substance that can be regarded as a fertiliser within the soil.

Enough has been advanced to recommend the study of the articles by Messrs Lawes & Gilbert, printed in the Royal Agricultural Journal. I now, therefore, pass to the consideration of the 2d article, at page 133 of the journal, with which, as I deem it to be of very great importance, I must take great liberties in the way of referential extracts. The writer, the Rev. G. Smith, vicar of Lois Weedon, Towcester, cursorily alludes to the papers by Mr Lawes, and observes that, "*without laying too much stress upon the minuter calculations of the interesting experiment described*, I

take it as far as it goes in confirmation of my scheme. This much is certain, that the atmosphere contains every organic constituent of wheat, in the forms of ammonia, carbonic acid, and water. The question is only one of efficiency," &c.

Mr Smith explains by its title the object he had in view when he wrote the article which was accepted by the publishing committee of the journal—*Experiment and experience* in the growth of wheat, year after year, *on the same acre of land.* "Last year," he adds, "I took in hand a measured field of 4 acres, in order to carry out more extensively my *experiment* in growing wheat."

It is quite evident from the following passage that Mr Smith, in the first instance, had studied the writings of the celebrated Tull. "I need scarcely say that, while in practice I differ wholly from Jethro Tull in the management of wheat, *the leading principles* by which I am guided *are his.* And Jethro Tull, whose veracity was never doubted, asserts boldly, that the more successive crops are planted at wide intervals, and often hoed, the better the ground does maintain them. The last crop is still the best without dung, or changing the sort of plant."

Mr Smith's *experience* he thus briefly relates:—"Seven years ago I broke up a few acres of pasture, having breast-ploughed the turf, and taken it off. Setting apart a portion of this land for my purpose, I devoted the first year to oats, the second to vetches, and the third year to my first crop of wheat *on the plan of* 3 *feet intervals*, and double digging. I have now the fifth crop (of wheat) on the same acre of unmanured land, promising at least, from *the half portion* of the acre, the customary yield of 34 bushels. The staple of this land was about 5 or 6 inches, with a subsoil of yellow clay, generally very tenacious, but here and there inclining to marl and sand. The stratum is oolitic, a formation of great extent running across the country from Melcombe Regis nearly to Whitby." Again: "Last October, I took in hand a measured field of 4 acres, in order to carry out more extensively my experiment in growing wheat. I ploughed the short stubble, for the field had just been in wheat, an inch deeper than the used staple; cleaned and levelled it, and got in my seed in channels made by the presser, covering over with the crusher." A sketch follows, giving a view of the growing plant, "the spaces *in* each triple row being 1 foot, and the intervals *between* each triple row 3 feet. The field I am describing is a gravelly loam, with a varied subsoil of gravel, clay, and marl. It has been hard worked for nearly a century, at least, by tenant after tenant; has never known a bare fallow in the memory of man; and my operations followed *immediately* after a heavy crop of wheat, sown broadcast. I applied no manure; and having dropped *single grains* about 3 inches apart into the pressed channels, I sowed but little more

than a peck of seed to the acre. During winter, and up to April, the plant looked so thin, and so very far between, as almost to excite ridicule. The wheat, however, began then to mat and to tiller. May came; and all through that trying month it kept its colour without a tinge of yellow, and now the well-tilled intervals have told upon the grain, which has swollen to a great size. The compact ears are enormously heavy and large. The reed-like straw has borne up against the storms, and at this moment there stands as fine a crop of wheat as I ever beheld, promising from *the half portion* of every acre a yield of from 36 to 40 bushels."

Mr Smith states, at page 137, that, for the better success of his plan, he prefers to sow wheat as early as possible in September, in order that the plant may tiller fully before winter, and so ripen evenly at harvest. Before the end of that month the thin green lines are distinctly visible, and then he at once sets to work in the intervals: thus, at the beginning of November, when the triple rows of wheat were so visible, he trenched the intervals for the succeeding crop, bringing up *six inches* of the *subsoil* to the surface, and casting the 7 inches of staple to the bottom.

On this reversal of the surfaces, something ought to be said. Many persons have found that a subsoil even of sandy clay, of a mellow, yellow tint, freely pulverisable, produced anything but fertility. In Berkshire, I tried a plot of several rods, on a meadow, with a view to create a deep staple, turning the turfs into the bottom of each 2-feet-wide trench. The disappointment was such that it became needful, before the next season, to change the earth, by re-trenching, and returning the top spit to the bottom, bringing up the turfy earth and a spit of the former surface-mould, and laying the middle spit over the subsoil. The rich mould, being thus at top, produced fine vegetables, and soon after the whole piece was planted with fruit-trees. My work was done deeply at the first. But Mr Smith tells us, that at the commencement of his labours, in trenching the intervals, he brings up only so much of the subsoil—say four, five, or six inches, according to its nature—as can be penetrated and decomposed by the atmosphere, and so prepared for use by *the one year's fallow*;—increasing the quantity year after year, till the staple has become two good spits deep. With respect to the advantage derivable from the progressive and *gradual* intermixture of the upper and lower soil, the high condition of Flemish husbandry, and the renovation of Lincolnshire, offer demonstrative evidences. Jethro Tull doubtless carried his tillage system too far, in neglecting to recruit his lands by the judicious addition of manures; but he sustained more injury from the obstinacy of his labourers. Yet the able statement which we find under the article "Tull, Jethro," in the *Penny Cyclopædia*, vol. xxv. p. 341, does not do his system justice, for it represents the land he formed as of excellent natural

quality; whereas (if we attach credit to his own report) it must appear that the reverse was the fact. "I am sorry," he says, "that this farm whereon, *only*, I have practised horse-hoeing, being situate upon a hill, that consists of chalk on one side, and heath-ground on the other, has usually been noted for the poorest and shallowest soil in the neighbourhood. My field, whereon is now the 13th crop of wheat, is likely to be very good, the crop before it having been the best that ever grew on it."—(See Smith's article, p. 134.)

The question of *manure* involves more important principles than many able cultivators imagine. Manure is considered the food of plants; but in reality, so infinitely divided are the roots, so minute the subdivisions of their hairlike rootlets, that not one *solid* particle, however fine it may be, can by any possibility enter into the organism; and even the colouring matter of infusion is equally refused. Organic decomposable substances—for such constitute the basis of farmyard and fold manure-heaps—must be reduced to mere water, or water combined with invisible gaseous matter, before they can be absorbed. Setting aside, therefore, for the present, the theory of absorption of gases by the organs of the leaders, (*stomata*,) and admitting the importance of *ammonia* assigned to it by Mr Lawes and Mr Smith, I suggest that, as putrescent manures must be removed, if it were only to get rid of a nuisance, it would always be wise to place them at the bottom of deep trenches in as recent and unfermented a condition as possible, thus obviating the loss occasioned by the expulsion of carbonic acid, ammonia, and hydro-carbonous gases. Deposited in a 6-inch layer, 2 feet at the least below the strata of well-comminuted arable earth, how secure would be all the exhalations, and how rich and durable the result of humus matter below, thus prepared to be brought up and incorporated with the staple by future operations! Here, deferring farther remarks on the theory and practice of others, I close this article by recurring to two or three paragraphs of Mr Smith's article, that appear worthy of reflection.

(Page 136.) "Under ordinary circumstances, gaseous *nitrogen* has shown but little tendency to combine with other bodies; but, on trial, nitrogen mixed with excess of *hydrogen*, and burned at a jet, produced *water* and *nitric acid*. On another trial, pure nitrogen, passed over a mixture of charcoal powder and carbonate of potass, produced *potassium* in quantity. Future trials may produce further discoveries. The late Dr Fownes, in a prize essay on the food of plants, (*Jour. of Royal Agr. Soc.*, vol. iv.) said, 'The chemical energies at work in a living plant are, to say the least, equal in power to those which we have under control in the laboratory;' and certainly, I may add, where the state of the soil affords an easy access to the roots of the plant, the supposition is not groundless that the *free nitrogen* of the air *may* take its part in

bringing the grain of wheat to perfection." Then with regard to the *inorganic food*, (that is to say, the mineral alkalies, potass and soda, the phosphates, the silicates of lime, alumina, and potassa, all easily supplied if found to be deficient,) Mr Smith says, "By a gradual exposure of the subsoil in the intervals, I provide a constant supply. I have little to contend with here, the question being not so much a question of sufficiency as of expense. For, hear Mr Way upon this point: 'Allowing,' he says, 'a certain and considerable yearly diminution of the mineral elements of fertility in the land, we have yet, so to speak, an almost infinite supply in the soil itself, provided we knew how we might economically avail ourselves of it.'"

In conclusion, as space will not permit me now to touch on the two other articles alluded to, Mr Smith has clearly shown that *he* knows, and instructs others, how to act efficiently. He has very recently published a statement in the *Mark Lane Express*, much more comprehensive of his practical system; and though I cannot go quite with him in rejecting manures, yet, as a practised gardener, and being fully aware of the vast advantages obtained in the best markets and other gardens by deep thorough tillage and rotations, I can duly appreciate the motive of any quibbling attacks that impugn the truth and validity of Mr Smith's theory and estimates. There are writers who oppose, for the sake of opposition, but who are, *de facto*, ignorant of principles or practice. Be it the object of every true farmer to *try* for himself, fully and to the utmost.

FIARS PRICES of the different COUNTIES of SCOTLAND, for Crop and Year 1851, by the Imperial Measure.

ABERDEEN.

	Imp. qr.
Wheat, without fodder	37/
——— with fodder	-
Barley, without fodder	22/8
——— with fodder	27/8
Bere, First, without fod.	22/6
——— with fodder	27/6
—— Second, without fod.	21/6
——— with fodder	26/6
Oats, Potato, without fod.	16/8
——— with fodder	22/8
— Common, without fod.	16/
——— with fodder	22/
Pease	22/1
Beans	23/4
Malt, duty included,	44/10
Oatmeal, per 140 lb.	12/8

ARGYLE.

Wheat	32/8
Barley	24/2
Bere	20/2
Oats	18/4
Beans	28/
Oatmeal, per 140 lb.	13/11½

AYR.

Wheat	33/0¾
Barley	23/3
Bere	21/3
Oats	15/8½
Pease	29/11¾
Beans	-
Oatmeal, per 140 lb.	13/9

BANFF.

Wheat	38/4
Barley, without fodder	22/10
——— with fodder	27/4
Bere, without fodder,	19/10
—— with fodder	24/4
Oats, Potato, without fod.	18/5
——— with fodder	23/11
— Common, without fod.	16/10
——— with fodder	22/4
Pease	25/2
Beans	26/9
Rye	-
Oatmeal, per 140 lb.	12/7

BERWICK.

Wheat	36/11 9/12
Barley, Merse	23/3 9/12
——— Lammermuir	21/4
Oats, Merse	18/1 5/12
—— Lammermuir	18/0 4/12
Pease	28/11 2/12
Oatmeal, per 140 lb.	14/9

BUTE.

	Imp. qr.
Wheat	35/8¼
Barley	21/9¾
Bere	18/4¼
Oats	19/5¾
Pease and Beans	-
Oatmeal, per 140 lb.	14/2¾

CAITHNESS.

Barley	18/4¾
Bere	19/8¾
Oats, Angus	16/2
—— Sandy	16/2
Oatmeal, per 140 lb.	12/6¼

CLACKMANNAN.

Wheat	33/11
Barley, Kerse	21/8
——— Dryfield	22/2
Oats, Kerse	18/11¾
—— Dryfield	17/9
Pease and Beans	28/9¼
Malt	45/5¾
Oatmeal, per 140 lb.	14/5

DUMBARTON.

Wheat	35/5
Barley	23/11
Bere	21/11
Oats	18/9
Pease and Beans	31/3
Oatmeal, per 140 lb.	14/9

DUMFRIES.

Wheat	39/4
Barley	24/6
Bere	22/
Oats, Potato	18/2
—— White	17/2
Rye	30/
Pease	-
Beans	30/10
Malt	61/
Oatmeal, per 140 lb.	13/4

EDINBURGH.

Wheat, First	37/6
——— Second	35/
Barley, First	24/7
——— Second	22/
——— Third	20/
Oats, First	19/6
——— Second	17/6
Pease and Beans	31/10
Oatmeal, per 112 lb.	11/6
——— 280 lb.	28/9

ELGIN AND MORAY.

	Imp. qr.
Wheat	39/1
Barley	24/7
Oats	18/10
Pease and Beans	31/8
Rye	23/1
Oatmeal, per 112 lb.	11/10

FIFE.

Wheat, White	37/7
——— Red	33/4¼
Barley	22/4¾
Bere	20/4¾
Oats	18/1¼
Rye	25/7¼
Pease and Beans	25/6¼
Malt	46/6¾
Oatmeal, per 112 lb.	11/3¼
——— 280 lb.	28/2¼

FORFAR.

Wheat	38/5
Barley	23/3
Bere	22/5
Oats, Potato	18/3
—— Common	17/11
Rye	23/2
Pease and Beans	27/10
Oatmeal, per 140 lb.	13/6

HADDINGTON.

Wheat, First	40/5¼
——— Second	38/8¾
——— Third	36/9
Barley, First	27/9¾
——— Second	26/1¼
——— Third	24/1
Oats, First	22/0¼
—— Second	20/10¾
—— Third	19/7¼
Pease and Beans, First	32/3
——— Second	30/5
——— Third	28/3¾

INVERNESS.

Wheat, without fodder	37/11
——— with fodder	42/11
Barley, without fodder	23/5¼
——— with fodder	27/5¼
Bere, without fodder	19/10¾
—— with fodder	23/10¾
Oats, without fodder	18/4
——— with fodder	23/10
Pease, without fodder	28/
——— with fodder	34/
Oatmeal, per 112 lb.	11/8

FIARS PRICES—*Continued.*

KINCARDINE.

	Imp. qr.
Wheat, without fodder	37/8¾
——— with fodder	46/2¾
Barley, without fodder	22/10½
——— with fodder	29/4½
Bere, without fodder	21/11¾
—— with fodder	28/5¾
Oats, Potato, without fod.	18/1¾
—— with fodder	25/7½
—— Common, without fod.	17/2¾
——— with fod.	24/8¾
Pease, without fodder	26/11
——— with fodder	32/11
Beans, without fodder	
——— with fodder	
Oatmeal, per 140 lb.	13/5

KINROSS.

Wheat	34/1
Barley, First	23/7
——— Second	21/1
Bere, First	
—— Second	
Oats, First	18/6
——— Second	16/11
——- Black, First	16/11
——— Second	16/2
Pease	25/9
Beans	
Oatmeal, per 280 lb.	27/6

KIRKCUDBRIGHT.

Wheat	38/4
Barley	24/2
Oats, Potato	18/6
—— Common	15/8
Oatmeal, per 140 lb.	13/4

LANARK.

Wheat, First	38/0¾
——— Second	32/11
——— Third	30/
Barley, First	23/7½
——— Second	21/4½
——— Third	18/1
Bere, First	20/4¾
—— Second	17/4
Oats, First	18/2½
—— Second	15/10¼
——— Third	11/7¾
Pease, First	
——— Second	
Beans, First	32/5½
——— Second	
Malt	46/
Oatmeal, First, per 140 lb.	14/7½
——— Second	12/8

LINLITHGOW.

Wheat	36/11
Barley	24/11
Oats	18/11

LINLITHGOW (*Continued.*)

	Imp. qr.
Pease and Beans	30/5
Malt	45/11
Oatmeal, per 112 lb.	12/1
——— 140 lb.	15/0

NAIRN.

Wheat	39/0
Barley, without fodder	23/6
——— with fodder	28/6
Oats, without fodder	19/
—— with fodder	25/6
Oatmeal, per 112 lb.	11/9

ORKNEY.

Bere, per 360 lb.	14/7
Malt, per 140 lb., with duty	15/8
—— per 140 lb., without duty	7/8
Oatmeal, per 140 lb.	10/9

PEEBLES.

Wheat, First	38/
——— Second	36/7
——— Third	35/
Barley, First	24/9
——— Second	22/11
——— Third	21/4½
Oats, First	18/2
—— Second	17/0¾
—— Third	15/9½
Pease and Beans, First	31/7
——— Second	29/3
——— Third	26/6¼
Oatmeal, per 140 lb. First	13/9¾
——— Second	13/5¾
——— Third	12/11

PERTH.

Wheat, First	39/3
——— Second	33/11
Barley, First	24/5
——— Second	21/4
Oats, First	18/7
—— Second	16/6
Rye	25/6¾
Pease and Beans	27/7
Oatmeal, per 140 lb.	13/7½

RENFREW.

Wheat, First	35/11½
——— Second	
Barley, First	23/3¾
——— Second	
Bere, First	22/5¾
—— Second	
Oats, First	18/7½
—— Second	
Beans, First	31/5
——— Second	
Pease, First	
——— Second	
Oatmeal, per 140 lb. First	14/4½
——— Second	

ROSS AND CROMARTY.

	Imp. qr.
Wheat, First	38/
——— Second	37/3
Barley	23/11
Bere	24/
Oats, First	19/10¾
—— Second	18/8¾
Pease	28/
Beans	28/
Malt	48/5
Oatmeal, per 140 lb.	14/4

ROXBURGH.

Wheat	37/2¼ [illegible]
Barley	23/2$\frac{6}{12}$
Oats	18/2$\frac{6}{12}$
Rye	23/5
Pease	28/0$\frac{5}{12}$
Beans	29/8$\frac{1}{12}$
Oatmeal, per 140 lb.	13/9¼ [illegible]

SELKIRK.

Wheat	36/4
Barley	23/4
Oats, Potato	18/
—— Common	17/9
Pease	28/6
Oatmeal, per 280 lb.	27/6

STIRLING.

Wheat	34/
Barley, Kerse	23/5$\frac{4}{12}$
——— Dryfield	22/10½
Oats, Kerse,	18/10¾
—— Dryfield	18/1$\frac{4}{12}$
—— Muirland	12/5$\frac{4}{12}$
Beans	29/8
Malt	44/10¾
Oatmeal, per 140 lb.	14/2

SUTHERLAND.

Wheat	37/6
Barley	26/3
Bere	24/
Oats	18/5
Pease	
Beans	
Oatmeal, per 140 lb.	15/

WIGTOWN.

Wheat	34/8
Barley	23/1$\frac{4}{12}$
Bere	18/8
Oats, Potato	17/4
—— Common	16/4
Rye	18/8
Pease	
Beans	27/4
Malt	
Oatmeal, per 280 lb.	27/3¾

We may inform our English readers, that Fiars Prices are the average prices of grain, as ascertained every year, by the verdict of Juries, in every County of Scotland. The Juries are summoned in spring, and ascertain, from the evidence produced to them, the average prices of the preceding crop. By these prices, rents payable in grain, and similar contracts, are generally determined ; but the main object is to convert into money the stipends (for the most part fixed at a certain quantity of grain) of the Scottish Clergy.

PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat. s. d.	Barley. s. d.	Oats. s. d.	Rye. s. d.	Pease. s. d.	Beans. s. d.
1852. Feb. 7.	43 9	32 1	20 10	29 8	32 10	28 11
14.	44 9	30 11	19 3	30 2	31 7	28 10
21.	44 10	32 2	20 1	30 10	33 1	28 11
28.	46 1	31 9	20 1	32 6	31 0	28 9
Mar. 6.	47 7	30 5	19 2	32 7	31 11	28 10
13.	44 9	31 3	19 6	31 6	30 7	30 0
20.	45 1	29 10	19 10	32 6	30 6	29 10
27.	45 6	31 0	19 7	32 10	31 8	30 1
Apr. 3.	44 10	30 1	19 3	32 9	30 10	29 1
10.	45 3	30 4	23 8	33 0	30 7	28 11
17.	46 0	29 11	19 5	33 1	32 7	28 5
24.	43 11	29 7	19 2	32 10	33 4	29 8
May 1.	44 5	29 7	20 6	32 2	29 0	28 6
8.	44 4	28 7	19 11	32 4	31 2	30 5
15.	45 8	30 11	19 10	32 7	26 6	27 8
22.	43 5	27 6	20 5	31 8	33 10	30 4
29.	43 10	31 6	20 6	30 6	32 6	29 9

EDINBURGH.

Date.	Wheat. s. d.	Barley. s. d.	Oats. s. d.	Pease. s. d.	Beans. s. d.
1852. Feb. 4.	41 1	27 10	21 11	32 0	32 7
11.	40 3	25 3	21 4	31 8	32 4
18.	39 1	28 8	21 3	32 0	32 6
25.	40 4	28 11	21 6	32 6	33 3
Mar. 3.	41 9	29 9	22 9	33 6	34 2
10.	42 9	30 7	23 1	34 0	34 6
17.	42 7	31 7	23 6	34 6	35 5
24.	43 7	30 10	22 11	34 0	34 6
31.	43 6	31 6	22 6	33 6	33 9
Apr. 7.	42 1	30 6	21 10	32 0	32 8
14.	41 9	30 1	21 3	32 6	33 0
21.	41 10	29 9	21 1	32 0	32 8
28.	42 9	30 4	21 5	32 8	33 5
May 5.	42 5	30 4	21 3	32 4	32 1
12.	41 4	30 8	21 4	32 2	32 10
19.	41 8	30 11	21 4	32 6	33 2
26.	42 8	30 5	22 3	32 1	32 9

LIVERPOOL.

Date.	Wheat. s. d.	Barley. s. d.	Oats. s. d.	Rye. s. d.	Pease. s. d.	Beans. s. d.
1852. Feb. 7.	40 5	26 11	18 6	28 9	27 0	30 0
14.	41 7	28 2	19 11	28 4	28 2	30 4
21.	42 4	25 3	20 1	27 6	28 6	30 8
28.	42 0	26 11	20 11	26 1	29 4	30 6
Mar. 6.	41 11	26 5	18 8	32 11	28 8	32 5
13.	43 0	28 0	22 3	32 2	27 0	32 5
20.	42 4	27 4	21 6	31 4	34 6	30 9
27.	42 5	27 7	21 4	30 8	32 8	30 10
Apr. 3.	40 3	26 11	20 9	30 4	31 2	31 0
10.	41 7	28 1	21 6	31 2	30 8	31 6
17.	39 9	26 10	20 8	30 7	30 2	31 5
24.	42 0	24 4	19 10	30 10	29 8	35 2
May 1.	41 1	27 11	21 2	30 2	29 2	37 3
8.	41 3	31 8	22 0	29 8	29 10	33 11
15.	41 4	27 11	21 0	29 6	30 3	34 3
22.	41 10	25 8	20 5	29 1	29 9	33 5
29.	43 2	24 4	23 0	28 6	29 6	32 0

DUBLIN.

Date.	Wheat, p. barl. 20 st. s. d.	Barley, p. barl. 16 st. s. d.	Bere, p. barl. 17 st. s. d.	Oats, p. barl. 14 st. s. d.	Flour, p. barl. 9 st. s. d.
1852. Feb. 4.	23 8	14 6	13 1	11 2	14 2
11.	23 10	14 5	12 11	11 3	14 3
18.	24 8	14 2	12 9	10 11	14 5
25.	23 3	14 9	13 2	11 1	14 3
Mar. 3.	24 10	13 3	12 6	10 11	14 4
10.	26 5	14 2	13 0	11 3	14 6
17.	22 11	13 8	12 8	11 7	14 0
24.	24 4	14 0	12 10	11 4	14 2
31.	23 11	12 6	11 9	11 3	14 1
April 7.	23 6	14 4	12 8	11 2	14 0
14.	23 0	14 1	12 4	11 10	14 2
21.	23 0	14 5	12 8	11 9	14 0
28.	24 6	13 11	12 1	11 7	14 4
May 5.	24 6	13 6	11 10	11 5	14 5
12.	23 7	14 3	12 3	11 4	14 3
19.	24 0	14 1	12 2	11 4	14 1
26.	24 1	12 7	11 9	10 11	14 2

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vic., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat. Weekly Average. s. d.	Wheat. Aggregate Average. s. d.	Barley. Weekly Average. s. d.	Barley. Aggregate Average. s. d.	Oats. Weekly Average. s. d.	Oats. Aggregate Average. s. d.	Rye. Weekly Average. s. d.	Rye. Aggregate Average. s. d.	Pease. Weekly Average. s. d.	Pease. Aggregate Average. s. d.	Beans. Weekly Average. s. d.	Beans. Aggregate Average. s. d.
1852. Feb. 7.	41 2	38 10	29 8	27 7	18 11	18 2	29 7	28 3	29 0	28 6	29 0	28 7
14.	42 8	39 9	30 7	28 4	18 9	18 4	29 11	28 9	29 7	28 9	29 10	28 9
21.	42 9	40 8	31 0	29 1	19 4	18 7	30 5	28 10	30 5	29 2	30 2	29 0
28.	42 3	41 4	30 7	29 8	19 6	18 10	30 7	29 4	29 5	29 3	29 10	29 4
March 6.	42 7	41 11	30 1	30 1	19 4	19 0	32 5	30 1	29 6	29 4	30 2	29 8
13.	42 10	42 5	30 5	30 4	19 9	19 3	30 5	30 7	29 7	29 7	30 1	29 10
20.	42 8	42 7	30 3	30 5	19 9	19 5	31 11	30 11	29 10	29 9	30 4	30 1
27.	42 2	42 6	30 2	30 5	19 6	19 6	30 5	31 0	29 8	29 9	30 3	30 2
April 3.	41 7	42 4	29 9	30 2	19 4	19 7	32 3	31 4	29 7	29 7	30 0	30 1
10.	41 4	42 2	29 4	30 0	19 7	19 7	32 8	31 8	29 2	29 7	29 11	30 1
17.	40 10	41 11	29 1	29 10	19 4	19 7	33 6	31 10	29 11	29 8	29 10	30 0
24.	40 4	41 6	27 8	29 4	19 3	19 6	31 7	32 1	30 2	29 9	30 3	30 1
May 1.	40 6	41 1	28 5	29 1	19 9	19 6	31 0	31 11	29 4	29 8	30 0	30 1
8.	41 1	40 11	28 1	28 7	19 8	19 6	30 8	31 10	30 5	29 9	30 5	30 0
15.	41 3	40 10	28 3	28 6	19 10	19 7	30 0	31 7	29 2	29 9	31 0	30 3
22.	40 6	40 9	27 10	28 3	20 1	19 8	30 5	31 2	30 9	30 0	31 6	30 6
29.	40 5	40 8	27 11	28 0	20 1	19 9	30 0	30 7	27 2	29 6	31 7	30 9

FOREIGN MARKETS.—Per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Feb. ..	Danzig	42 0 - 47 6	20 6 - 30 0	16 0 - 20 0	32 6 - 41 0	26 6 - 34 0	21 6 - 27 0
March	Danzig	40 6 - 45 0	19 6 - 28 0	17 0 - 21 6	30 0 - 35 0	27 6 - 33 0	22 6 - 28 6
April..	Danzig	39 6 - 44 0	18 6 - 27 0	17 0 - 20 6	31 6 - 36 0	26 6 - 36 0	24 0 - 29 6
May ..	Danzig	38 0 - 43 0	18 0 - 26 0	15 6 - 19 6	30 6 - 35 6	25 6 - 32 0	22 6 - 27 0
Feb. ..	Hamburg	39 6 - 43 6	26 6 - 33 0	14 6 - 17 6	33 6 - 38 0	26 0 - 30 0	23 6 - 29 0
March	Hamburg	38 6 - 43 0	24 0 - 30 6	15 0 - 18 6	31 6 - 37 0	26 6 - 32 0	24 0 - 29 6
April..	Hamburg	36 6 - 42 0	23 6 - 30 0	15 6 - 18 6	32 6 - 38 0	27 0 - 33 0	24 6 - 29 0
May ..	Hamburg	35 0 - 41 0	23 0 - 31 0	14 0 - 17 6	30 0 - 35 0	27 6 - 34 0	24 0 - 29 0
Feb. ..	Bremen	40 6 - 46 0	22 6 - 29 0	16 6 - 21 0	28 6 - 36 6	32 0 - 40 0	26 6 - 32 0
March	Bremen	38 6 - 44 0	22 0 - 28 6	17 6 - 22 0	29 0 - 37 0	28 6 - 37 0	27 6 - 33 0
April..	Bremen	36 6 - 42 0	21 6 - 27 6	16 0 - 20 0	28 6 - 36 0	26 6 - 35 0	26 0 - 31 6
May ..	Bremen	35 0 - 41 6	20 0 - 26 0	15 0 - 19 6	26 6 - 35 0	25 6 - 33 0	25 0 - 30 0
Feb. ..	Königsberg	36 6 - 43 6	20 6 - 29 0	15 6 - 19 6	30 6 - 36 0	26 0 - 32 0	24 0 - 31 6
March	Königsberg	38 6 - 45 0	22 6 - 30 0	16 6 - 21 0	31 6 - 37 0	27 6 - 33 0	25 0 - 32 6
April..	Königsberg	37 0 - 44 0	20 0 - 28 6	15 6 - 20 0	30 0 - 35 0	26 6 - 31 6	24 0 - 31 0
May ..	Königsberg	36 0 - 42 0	19 6 - 27 0	14 6 - 18 6	30 6 - 35 6	25 0 - 30 6	22 6 - 30 0

Freights from the Baltic, 2s. to 3s. 3d.; from the Mediterranean, 5s. 6d. to 8s.; and by steamer from Hamburg, 1s. 3d. to 2s.

THE REVENUE.—From 5th April 1851 to 5th April 1852.

	Quarters ending April 5.		Increase.	Decrease.	Years ending April 5.		Increase.	Decrease.
	1851.	1852.			1851.	1852.		
	£	£	£	£	£	£	£	£
Customs....	4,548,266	4,615,025	66,759	..	18,730,562	18,827,828	97,266	..
Excise......	1,980,536	2,070,064	89,528	..	13,125,024	13,182,698	57,674	..
Stamps.....	1,548,008	1,515,985	..	32,023	6,105,524	5,901,526	..	203,998
Taxes......	167,784	295,048	127,264	..	4,350,731	3,691,226	..	659,505
Post-Office..	272,000	259,000	..	13,000	861,000	1,051,000	190,000	..
Miscellaneous	61,974	121,733	59,759	..	312,566	380,000	69,434	..
Property Tax	2,389,950	2,068,827	..	21,123	5,403,379	5,283,800	..	119,579
Total Income	10,968,518	10,945,682	343,310	66,146	48,888,786	48,318,078	414,374	983,082
	Deduct decrease		66,146		Deduct increase			414,374
	Increase on the qr...		277,164		Decrease on the year..			568,708

PRICES OF BUTCHER-MEAT.—Per Stone of 14 Pounds.

Date.	London. Beef.	London. Mutton.	Liverpool. Beef.	Liverpool. Mutton.	Newcastle. Beef.	Newcastle. Mutton.	Edinburgh. Beef.	Edinburgh. Mutton.	Glasgow. Beef.	Glasgow. Mutton.
1852.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Feb. ..	4 4 - 6 6	4 6 - 7 3	4 3 - 6 6	5 6 - 7 0	4 3 - 6 6	4 9 - 7 0	5 6 - 6 6	5 6 - 6 9	5 6 - 6 9	5 6 - 7 0
March	4 3 - 6 9	4 6 - 7 9	4 3 - 6 3	5 9 - 7 6	4 6 - 7 0	4 9 - 7 3	5 6 - 6 9	5 6 - 6 9	5 6 - 6 9	5 6 - 7 0
April ..	4 3 - 6 3	4 6 - 7 6	4 3 - 6 0	5 6 - 7 0	4 3 - 6 3	4 6 - 7 0	5 3 - 6 6	5 3 - 6 6	5 6 - 6 6	5 6 - 6 9
May ..	4 0 - 6 3	4 6 - 6 6	4 0 - 6 0	5 0 - 6 6	4 0 - 6 0	4 3 - 6 3	4 9 - 6 3	5 0 - 6 3	5 3 - 6 6	5 6 - 6 6

PRICES OF ENGLISH AND SCOTCH WOOL.—Per Stone of 14 Pounds.

English.	s. d. s. d.	Scotch.	s. d. s. d.
Merino,	13 6 to 17 6	Leicester Hogg,	11 6 to 16 6
.. in grease,	9 0 to 14 0	.. Ewe and Hogg,	9 6 to 14 0
South-Down,	14 0 to 17 6	Cheviot, white,	10 6 to 13 6
Half-Bred,	10 6 to 14 6	.. laid, washed,	7 6 to 10 0
Leicester Hogg,	10 6 to 16 6	.. unwashed,	6 6 to 8 6
.. Ewe and Hogg,	9 0 to 14 0	Moor, white,	6 3 to 8 3
Locks,	6 6 to 8 0	.. laid, washed,	5 6 to 7 3
Moor,	5 0 to 6 0	.. unwashed	5 0 to 6 3

AGRICULTURAL ARCHITECTURE AND ENGINEERING.—No. VI.

By R. S. Burn, M.E., M.S.A., Author of "Practical Ventilation," "Hints on Sanitary Construction," &c.

(*Continued from* p. 342.)

We have yet to point out some further requisites in the arrangement of a well-devised structure, more especially desiring our remarks to be taken in connection with houses for the labouring classes. Our opinions as to the desirableness of attending to this class of domestic structures, so as to provide for them all arrangements calculated to promote health and decency, have been previously stated, so that it is deemed unnecessary any further to dilate on this important point; we shall therefore at once proceed to the matter in hand. And first as to the living-room apartment. As we have already stated, the supply of light should by no means be stinted: and with regard to the principal entrance, by which admission is gained to the living-room, it ought to be held as imperatively necessary that it should open to a porch or passage, the entrance to the room being by an interior door. The plan (too largely adopted) of entering at once from the exterior to the living-room, is inducive of a vast amount of personal discomfort and domestic inconvenience. Domestic privacy is what every well-regulated mind wishes to secure, and this cannot be attained in anything like the degree to which every man is entitled, where the arrangement we have now indicated is not carried out. This point may be by some considered as one of those "small things" not worth attending to, nevertheless it is one which no little experience in domestic arrangement has shown us tends very materially to our domestic comfort and economy; we have therefore thought it right to notice it. Ample corroboration as to the value of our recommendation can easily be obtained from numerous occupants of labourers' dwellings. If the sleeping apartments are on the ground-floor with the living-room, access should be gained to them without passing through it. If the bedrooms are on the second floor, a separate staircase should be made, to avoid the necessity of having to pass through the public room. This isolation of the bedrooms is a very important point, and has been properly urged by nearly all writers on the subject. The kitchen should have, if possible, a small scullery attached, in which washing of linen, &c., can be carried on. The cultivation of habits of cleanliness and order should invariably be encouraged among the working classes, and the structural arrangements should be such as to have this tendency: where the contrary rule is adopted, and it is expected "that the habit will precede the convenience," disappointment will inevitably be the result. The scullery should be supplied with a good-sized slop-stone, made of freestone or polished slate, or white Hopton-wood stone; the hollow part

should be cut very shallow—not more than inch and quarter or half—and rounded off so as to leave no corners for dirt to lodge in. As a rule, we should recommend slop-stones to be used in preference to "sinks;" these being generally too deep and small, and serving to hold dirt, besides being almost totally useless for washing large pots, plates, dishes, &c., in. The recollection of the filthy condition of some of these receptacles we have seen in rather better-class houses in Edinburgh and Glasgow, would at once induce us to recommend slop-stones in their place. We feel quite confident that such a filthy condition of affairs would not, could not, have been tolerated in a flat, open, and exposed slop-stone. The very depth and narrowness of the "sinks" induces a great amount of carelessness as to their condition of cleanliness. The slop-stone should be so inclined that the water will naturally descend to one corner, at which the "trapped" entrance to the pipe leading to the drain should be placed. A liberal supply of water should be easily attainable at one end of the slop-stone; care should be taken to have the stopcock at such a height as to allow tubs, &c., to be easily placed beneath to be filled—want of attention to this little point having created much inconvenience. Where the size of the scullery will allow of it, a small copper or boiler should be placed in one corner, by which a supply of hot water may be easily obtained for washing, &c. This is an important matter, and should, if possible, be attained. The furnace should have an independent flue. An ash-pit should be provided in the yard, or back of building next to the water-closet, provided with a door through which the ashes can be passed. The ash-pit should in all cases be covered over, and the door made to fit tightly, so as to prevent the escape of effluvia from any decomposing substances placed in it. No liquid should be passed into the ash-pit, it all being made to pass to the cesspool from the slop-stone, or soil-pan of the water-closet.

Another point to be attended to is, that each house shall have a separate privy or water-closet, free from the control of neighbours, and as isolated as possible, so as not to be overlooked by the windows of the kitchen, scullery, or living-room. These conveniences are imperatively necessary in, or to every house, no matter whether high rented or low rented, in which comfort and health are desiderated. The total want of them involves a condition of matters so completely opposed to morality and good social arrangements, that it is scarcely possible to conceive of a people so utterly lost to a sense of that which is so conducive not only to health and comfort, but to decency, as to make no provision of this nature within or near the precincts of their dwellings; and yet it is a melancholy truth—and "pity 'tis 'tis true"—that numerous houses, in many of the towns and villages of Great Britain, afford a parallel to this sad social condition. In London there are many houses utterly without them; the same may be said of Edinburgh,

of Glasgow, and of Manchester, not to enumerate further from a list that would be wearisome from its length.

Houses should not be allowed to be tenanted without these conveniences. He who can look for honesty from the tenants of such barbarous structures, must have his mental faculties much obtused, and is in every way worthy to have, through the medium of a pecuniary loss, the proper results of cause and effect made fully known to him. Happy he who, receiving the lesson thus, can profit by it. It is a keen satire upon a man's humanity, the grave discussion as to whether the rent of a house will allow—so the phrase goes—these appliances to be attached which tend to promote alike health, cleanliness, and decency;—just as if it was a matter of common belief amongst a certain class, that those alone who could pay for it had the right to be assisted by proper contrivances in making domestic life as consistent with morality and comfort as possible. To such, the following beautiful sentiment of Bentham may be suggestive: "Between physical and moral delicacy a connection has been observed, which, though founded by the imagination, is far from being imaginary. Howard and others have remarked it. It is an antidote against sloth, and keeps alive the idea of decent restraint, and the habit of circumspection. Moral purity and physical are spoken of in the same language: scarce can you inculcate or command the one, but some share of approbation reflects itself upon the other. In minds in which the least grain of Christianity has been planted, this association can scarce fail of having taken root; scarce a page of Scripture but recalls it." Where access can be had to the water-closet in back-yard, without having to pass through the living-room or kitchen, another approach to perfect structural arrangement is effected. Where the size of the house will admit of it, this should be carried out; it is a point frequently lost sight of, but one the benefit of which is apparent upon its mere consideration. In the house we give in Plate I., and of which fig. 100 is the ground-plan, this arrangement has been adopted.

There is one point in the arrangement of cottages for the working-classes which ought to be especially attended to—that is, having as many separate bedrooms as possible in proportion to the intended or expected inhabitants. There is something especially revolting to a well-constituted mind in the very idea of a promiscuous sleeping apartment; and yet how often is such an arrangement carried out. It is quite unnecessary for us to cite evidence in proof of this; we could easily show how disgracefully prevalent the system is, and of how much and fearful an amount of depravity it is inducive. We shall merely note that one eminent authority states, that parties who were subjected to all its inconveniences and temptations, again and again represented to him that all sense of decency had to be overcome, more especially in cases of disease, or else they had to submit to great privation,

suffering, and increased sickness. Those who know human nature at all, know well which alternative would be adopted. The system of overcrowding in one apartment is also inducive, as may be expected, of much physical disease, as well as of immorality. The sequence of results has thus been well stated: "Overcrowding is a cause of extreme *demoralisation and recklessness;* and recklessness, again, is a cause of disease." The reader will find one or two notes on this subject in page 13, No. xxxiii. of this Journal, at the commencement of our present article. Not only, however, should the bedrooms be separate, so as to insure to each class of the family a distinct apartment, but it is also necessary that each should be completely isolated from its neighbour—that is, one bedroom should not be entered through another. This may be considered unnecessary, or difficult to be attained; doubtless many view it in this light, as even in some first-rate mansions it is not desiderated; nevertheless it is what we consider necessary to be adopted in a well-arranged dwelling.

With respect to conveniences—as cupboards, &c., for storing the multifarious utensils, &c., usually required in a house—it may be taken as a rule, that the more there are of these the better. We never yet knew of a house that the housewife considered she had too many; the reverse is the rule. Internal cupboards—that is, placed neither against an external wall, nor within too close a propinquity to the fireplace—are exceedingly useful for keeping preserves, &c., and such like matters in, as they are neither too damp to mould, or too hot to dry them up. With regard to storage places for meat, and quickly perishable articles, it is essentially necessary that these should be cool. We are decidedly in favour of having an underground apartment or cellar, however small, for this purpose. The original cost is comparatively trifling, and the advantages derived from it very great. In the district in which we now write, it is calculated that a large saving is effected in domestic arrangements during the summer months by having underground cellars. So highly are they appreciated, and their value understood, that a cellar to a house is a *sine quâ non.* All kinds of eatables are much better kept in a separate apartment. The cellar should be provided with a stone slab of considerable dimensions, raised from the floor, on which to place meat, milk, &c. If a cellar or underground pantry is considered too expensive, a small safe should be made in a recess in the wall of the kitchen; this may project outwards from the wall, which may tend to keep the interior cooler.

Where cottages are erected in rows, it is necessary that each house should be quite distinct from its neighbour—such as having distinct back-yards, &c. This, by good authorities, is considered an essential point, and our experience is in favour of its being adopted. We are no advocates of any place attached to a set of houses being common to all, unless under proper and well-regu-

lated authority. Those at all acquainted with the subject are aware that it is frequently a cause of much contention, with consequent bad moral effect. A certain degree of exclusiveness in domestic life seems necessary, and it should be met by proper arrangements. We have thus drawn out a variety of hints, the majority of which, if acted upon, will tend to give some degree of satisfaction in structural arrangements. We shall now proceed to lay before our readers plans, &c., of structures adapted for the various classes in agricultural districts.

On fig. 85 we give the ground-plan of a row of four cottages, drawn to a scale of 1-16th of an inch to the foot, comprising a

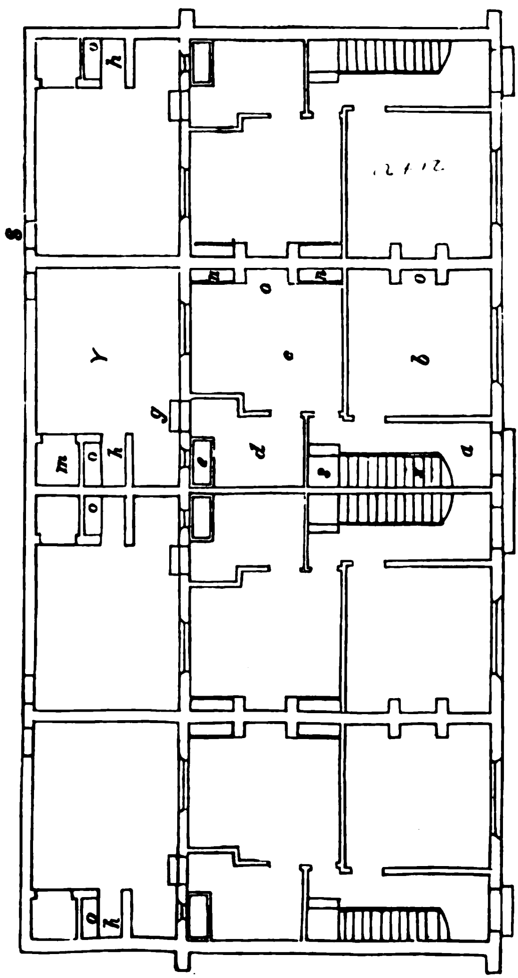


Fig. 85.

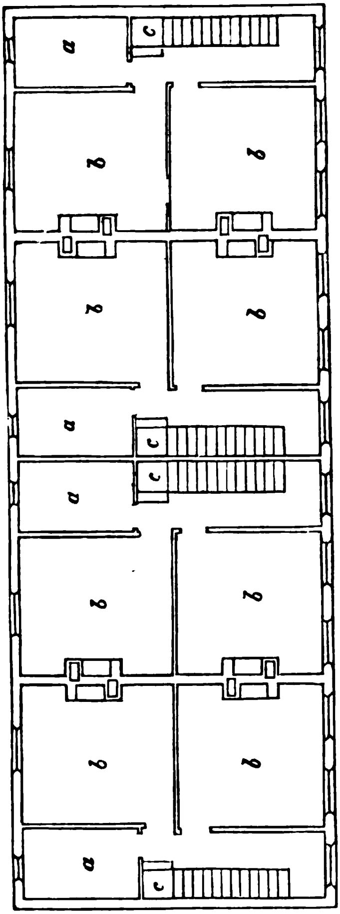
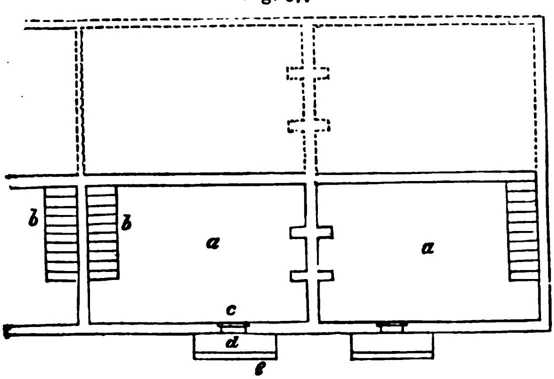


Fig. 86.

living-room or parlour *b*, 12 feet by 12 feet, lighted by a three-light window; a kitchen *c*, 12 feet 6 inches long by 11 feet mean width, lighted by a two-light window; scullery *d*, 9 feet 6 inches by 6 feet 6 inches mean width, fitted with a slop-stone or sink *e*, and lighted by a small one-light window. The entrance-lobby *a* is 5 feet 6 inches wide—the stairs, *s s*, being 2 feet 6 inches wide. On the sides of the fire-place *o*, in the kitchen, cupboards, *n n*, are fitted up, (see *Specification*, p. 434.) The entrance to the back-yard is at *g*, through the scullery. The yard *y* is 17 feet 9 inches by 12 feet; and contains ash-pit *m*, and water-closet *h*, 3 feet 6 by 3 feet 6 inches. Entrance is gained from the yard to the garden at the back of the house through the doors at *s*.

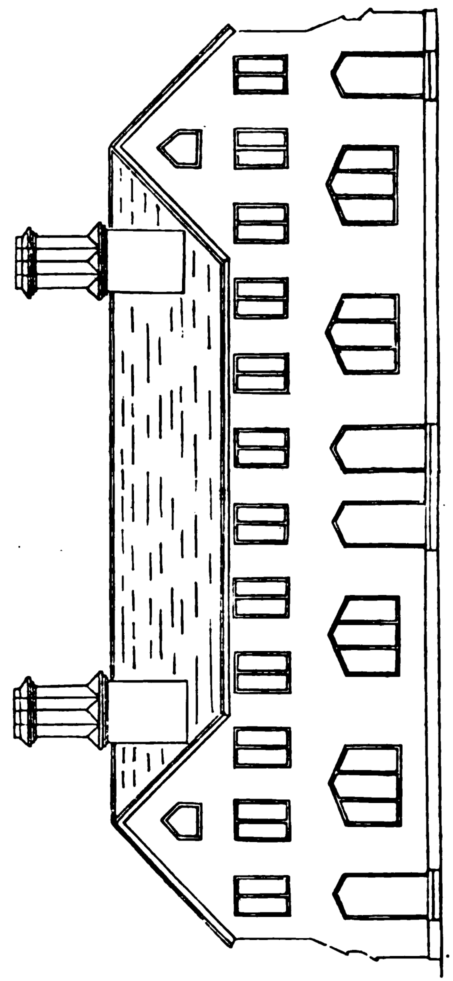
In fig. 86 we give the chamber plan, drawn to same scale as ground-plan, comprising front bedroom *b*, lighted by two two-light windows—dimensions 12 feet square; a back bed-room *b*,

Fig. 87.



lighted by a two-light window—dimensions 12 feet 6 inches by 11 feet 6 inches ; children's bedroom *a*, 8 feet 6 inches by 6 feet, lighted by a one-light window. In fig. 87 we give the cellar plan, (half,) drawn to same scale as chamber plan. The stairs *b*, 2 feet 6 inches wide, are entered from beneath the stair in

Fig. 88.



the entrance-lobby on the ground-floor. The store-room *a*, 17 feet 7 by 12 feet, is lighted by a small sash-window at *c* ; *d* being the area, covered with an iron grating at level of ground, beneath the window in front. The double line at *e* shows the amount of batter.

In fig. 88 we give the front elevation, drawn to same scale as ground-plan. From the minuteness of the scale, we have omitted

Fig. 89.

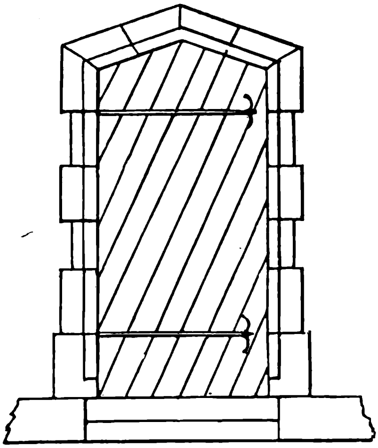
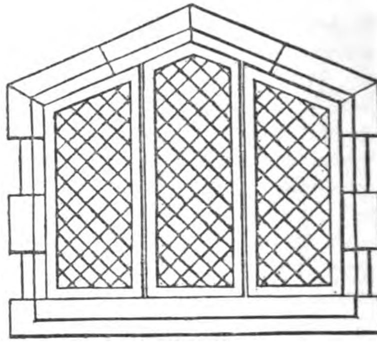


Fig. 90.



the window dressings, &c., but have supplied them in separate detail drawings, as in fig. 89, which is an elevation of front entrance-door, with stone dressings complete, drawn to a scale of

Fig. 91.

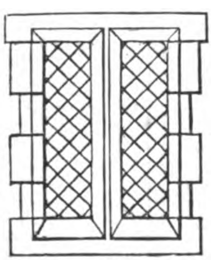


Fig. 92.

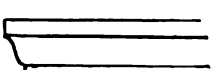
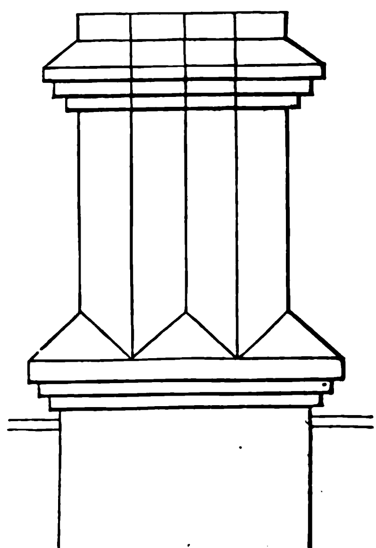


Fig. 93.



1-4th of an inch to a foot. In fig. 90, an elevation of the front sitting-room window, with dressings and fittings complete; scale as above. In fig. 91, an elevation of two-light window to front bedroom and to landing over lobby, drawn to same scale as above.

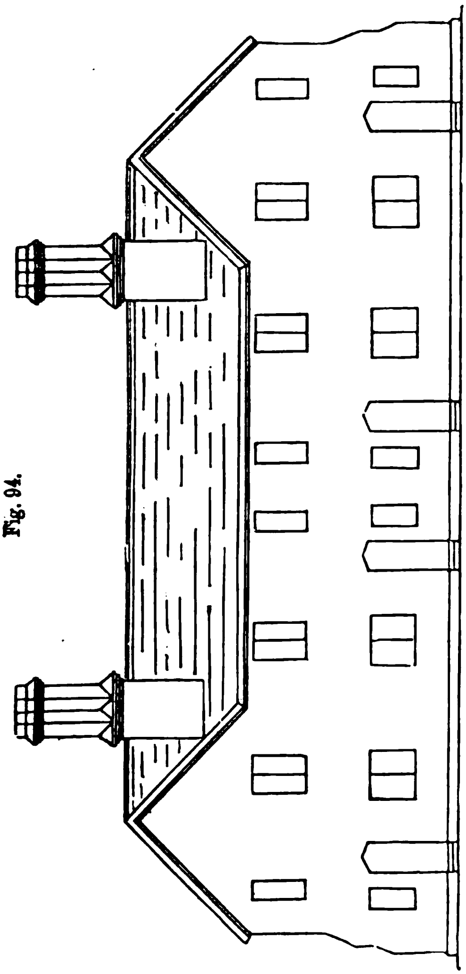


Fig. 94.

Fig. 95.

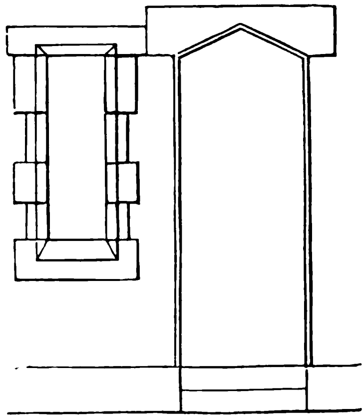


Fig. 96.

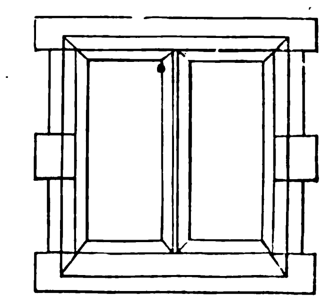
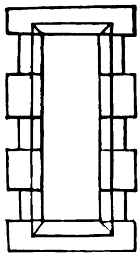


Fig. 92 is an enlarged view of projecting end of barge board. Fig. 93 is elevation of chimney to a $\frac{1}{4}$-inch scale. In fig. 94 we give back elevation; same scale as front. Fig. 95 is elevation of back-door and scullery window. Fig. 96, elevation of two-light window

Fig. 97.



to kitchen; and fig. 97 that of window to children's bedroom. The dressings to back bedroom windows same as this. Fig. 98 is an end elevation—scale same as front; and fig. 99 a transverse section from front to back of house.

Fig. 99.

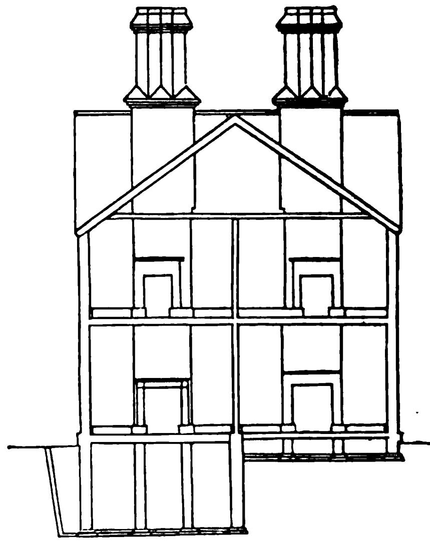
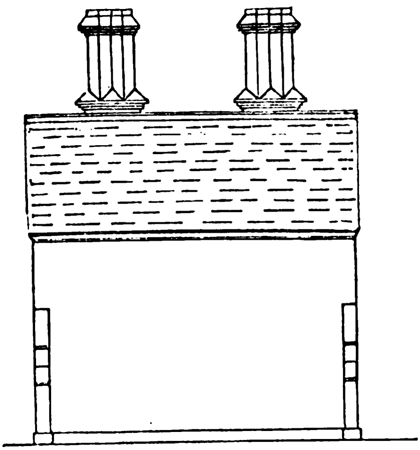


Fig. 98.



The description of fittings, external and internal, will be found in the following Specification, which we now present:—

SPECIFICATION of Sundry Works to be done in erecting Four Cottages for ——— ———, in the Parish of ———, according to accompanying drawings, figs. 85 *to* 99 *inclusive.*

Excavator.—Dig out and cart away ground for the foundations, to the depth from ground-line as in the section; also for drains, liquid-manure tank, &c. The excavations for drains to be made with a sufficient fall to liquid-manure tank, (see notes on Drainage.) To dig out the ground under front living-room and lobby for cellar, to the depth shown in section; also under floors of kitchen and scullery, to the depth of 1 foot below floors. Fill in and ram all the foundations and other walls, and cart away all superfluous earth and rubbish.

Bricklayer.—Carry up all the walls, external and party, 9 inches in thickness, to the several heights shown in the section; the mortar to be well mixed and tempered together, in the proportion of 1 bushel of good stone-lime to 2 of good, clean, sharp river or other approved sand.

The bricks to be of quality and kind as decided by the landlord, or easiest obtainable in the neighbourhood. Lay the whole of the brickwork in Old English band—the exterior to be worked fair, and finished with a flat-ruled joint; the interior to be left rough for plastering.

Turn half-brick trimmer arches to all the openings of fireplaces, and carefully

carry up same at a proper angle. Make air-chamber at back of fireplaces in living-room and kitchen, (see notes on the Construction of Fireplaces); make circular openings, 9 inches in diameter, communicating with same, above skirting in room, and close to fireplace jamb. Provide and lay in 4-inch drain tube, glazed, communicating with the interior of air-chamber at back of fireplace and the external atmosphere. Provide, in like manner, (see p. 302, No. xxxvi. of this Journal,) a 2-inch pipe leading to cavity beneath hearth-stone, to supply fireplace with air. Run up at back of fireplaces pipes to serve as "dust draughts," as described in fig. 73, p. 329 of this volume; or build in brickwork a 2-inch drain tube, communicating with ash-pit and chimney, as in illustration above noticed.

Carry up 9-inch circular chimney tubes for flues; or ventilating chimney tubes, as in figs. 65 and 66, p. 299—(these are here recommended.) If the flues are preferred to be run up in the brickwork, they should be made oblong, with the corners rounded off. The chimney-bearer in all the fireplaces to be of wrought iron. (The register-valve and chimney-bearer are recommended to be as in figs. 60 and 61, p. 298, No. xxxvi.) If ventilating chimney tubes are *not* used as in fig. 65, air-flues, 4 inches broad by width of flue, to be run up alongside of chimney flues, opening below ceiling to communicate therewith. If circular tubes are used for the chimney flues, provide and run up alongside of these 3-inch drain tubes, properly jointed, to serve as ventilating tubes. If the air-syphon ventilation is used, provide a flat zinc pipe, 3 inches by 2½ inches, and let same into brickwork in chimney breast—one end communicating with the flue by a circular bend, the other with an aperture near ceiling. The same to be provided to the front and back bedrooms. The children's bedrooms to have air-flues in wall leading to space between ceiling of bedrooms and external roof, formed of 3-inch drain-tube—the opening in room to be beneath the ceiling.

The chimney shafts to be set angularly, and carried up as in elevations and detail drawings, and to be finished externally with a neat trowel joint.

Construct two liquid-manure tanks behind fence wall, at the points of the division wall of yards, with filtering divisions, as fig. 8, p. 21, No. xxxiii.; size, 6 feet square by 6 feet deep, (internal dimensions;) face inside with 4-inch brickwork set in Roman cement, and done over with half-brick arch; provide man-hole, and cover same with stone slab, to be luted at the edges with clay to prevent escape of gas—or a rebated edge, inch deep and 2 broad, may be cut round the man-hole in which to lay slab cover. If preferred, the interior of tank to be formed of strong deal boarding lined with gutta percha. (See notes on Cesspools.) Construct over privy and ash-pit, to right and left hand corner houses, cisterns in 9-inch brickwork, external dimensions 9 feet by 5 feet, and 4 feet deep, lined with slate slab, or glazed flat tiles, to hold rain water; or, if preferred, internally deal-boarded and lined with gutta percha.

Construct above privies and ash-pits to *centre* houses, a rain-water tank as above, external dimensions 9 feet by 9 feet, and 4 feet deep.

Provide and fix with proper fall 4-inch drain tubes with *conical* joints, leading from sink in scullery, and from privies to cesspools; where bends or junctions are required, provide and lay *circular* ones.

Provide a soil-pan with trap to privies, connected with tube leading to cesspool.

All grates and ranges provided by the smith to be properly set and fixed. (See fig. 45, p. 206, No. xxxv., notes on Fireplaces.)

To bed in mortar all wood, bricks, bond-timbers, and to point well with lime-and-hair mortar all door and window frames.

To pave the privies with hard and well-burnt bricks set on edge in mortar laid on dry ashes or smiths' cinders.

Pave kitchen and scullery with flat paving tiles in mortar or dry ashes. (See notes on Floors.)

Pave lobby with flat tiles particoloured, in simple pattern or lozenge shape.

Mason.—The whole of the stone-work in external walls, consisting of heads, jambs, and sills to doorways and windows, to be of the best, (here describe *stone* most conveniently obtained in the neighbourhood,) properly worked in beds, joints, and faces, and set with chamfered angles and stopped ends, as shown in the drawings. (If the lobby is preferred paved instead of flat-tiled as above, pave all entrance passages with 2-inch paving laid to a close joint on brick sleeper walls, well stopped in composition.)

Provide and fix 3-inch treads to doors, and properly mortice the same to receive the door-posts.

Provide and fix rubbed stone-slabs and back hearths to all the fireplaces; the

slabs to project 20 inches from the face of the chimney-breast. The fireplaces throughout to be fitted up with 1½-inch rubbed Portland jambs, (or slate or other suitable material easily obtained in the neighbourhood;) mantels and shelf with rounded corners, each 6 inches in width, well cramped and secured together.

Cut in centre of hearth-stone, above cavity communicating with the air-flue to supply fireplace, an aperture 4 inches by 2, with rebated edge to lay grating in; the inner edge (see p. 302, No. xxxvi.) to be not more than 3 inches from line of fireplace bars.

Provide and fix in scullery a stone sink or slop-stone on brick bearers, of the size shown in plans 6 inches in depth; and cut hole in same to receive waste-pipe (leading to drains) and trap.

Provide a slab of   stone 2 inches in thickness and 2 feet square, to cover manhole of liquid-manure tank.

Provide and fix in cellar, close up to wall opposite window, a stone slab 4 feet by 2 feet, 2 inches thick, on which to place meat, milk, &c., to keep cool, on brick bearers 30 inches high.

Cut all holes, &c., for iron and other works where required.

Carpenter.—All the timber to be used to be good, sound, well-grown Baltic, Danzig, or Riga fir, well seasoned, and free from sap, shakes, or large and unsound knots, cut square and true to the several dimensions and lengths required; and no timbers to be fixed more than 12 inches apart, or to have a less bearing than a clear 4 inches on the plates, &c.

Provide a sufficiency of wood bricks, for joinery, to be inserted where required, also all centerings and turning pieces for chimney openings.

The quarter partitions throughout to consist of heads and sills 4 inches by 7 inches, posts 4 × 4, door heads, quarters, and braces 4 × 2, with the exception of the centre partition, which is to be as follows:—heads and sills 5 × 4, quarters and braces, 5 × 3. The interstices to be filled in with brickwork in mortar.

The joists in living-room, ground-floor, to be 7½ × 2½, 12 inches apart, having a clear bearing of 4 inches in walls.

The whole of the joists in first or chamber floor to be 7½ by 1¾; trimmers, 7½ by 2½; wall-plates 4 by 2½. The joists on this floor, when truly fixed, to have (if desirable) a row of herring-bone strutting, and to be properly fixed underneath for lathing.

The roof timbers to be 12 inches apart, and to consist of rafters 3½ by 2 inches, ceiling joists 3 by 2, wall-plate 4 by 2½, ridge 6 by 2, valley rafters 7 by 2.

Prepare the whole of the roofs for slates with 2½ by ¾ inch battens, well nailed to rafters. If zinc roofing is preferred, provide and nail to rafters single slabs, to lay zinc plates on. (See notes on Roofs and Roofing in a future Number.)

Joiner.—Lay the floors of dining-rooms on ground-floor and of all the bedrooms with inch yellow Christiana deals not more than 9 inches wide, with close joints, and well nailed, and bordered to slabs or hearthstone; the whole to finish clean up to the brick faces.

Provide and fix ¾-inch skirting 6 inches high, with proper grounds to receive the same in all the rooms.

The whole of the sashes to be 2½-inch deal, chamfer moulded and rebated to receive casements; 1-inch deal rounded linings and window board ploughed to receive plastering.

The shutters in lower story to be 1¼-inch deal, bead, butt, and square, hung with hinges in two leaves, and folding back against wall on the inside, and fastened with bow latch-spring fastening complete.

Provide and fix to all external doors a proper fir door-frame, mortised to heads of steps, and fitted with 1½-inch deal ledged door, hung with 3-inch butts, and to have two 1-inch rod bolts and iron rim, drawback lock and key.

The inner doors to be 1½-inch deal, square-framed, hung with 2½-inch butts and rounded linings, with stop grooved for plastering, and to be fitted with a 6-inch iron rim lock.

Provide and fix in recess on side of fireplace in living-room nearest the window, a tier of inch deal shelves on proper bearers, for books, &c.; and at other recess, a small cupboard 30 inches high, with flat deal top moulded at edge.

Provide and fix between chimney-breasts and walls in kitchen a small dresser with 1½-inch deal top, with sliders and runners for drawers with inch deal fronts, return beaded ⅝ deal rims and ½-inch bottoms. Provide and fix above this, three tier of

inch deal shelves on proper bearers, with plate fillet attached; also a ¾ deal pot-board and skirting complete. The drawers to be fitted with common black handles fixed with screws, and good drawer locks and keys. Provide and fix to closet on the other side of fireplace 1¼-inch beaded closet fronts, with inch deal, two panel square-framed doors, hung with 2½-inch butts, and fastened with turn-buckle fastening and cupboard locks complete; to have ¾ deal tops, inch deal rounded tops, and three tier of inch deal shelves inside.

The stairs to have inch deal treads and deal risers, framed into 1¼-inch strings, with proper carriages, and blocked with rounded end to bottom step; deal framed and turned newels, with deal elliptical hand-rail, and square bar balusters. The spandrel to be filled in with 1¼-inch deal framing.

Provide and fix in recess in side of fireplace next window, in front bedrooms, a two-basined wash-stand; basins to be fixtures, and communicate with drains by inch pipes. (See fig. 32, p. 199, in No. xxxv.) Fix one-basined stands in back bedroom. Provide and fix in other recess a neat plain wardobe with folding-doors, and fitted with shelves as desired.

Provide and fix to cellars sash windows or French, opening inwards, as may be desired.

Provide and fix to privies 1¼-inch deal proper ledged doors, with stop and rounded linings, hung with 3-inch butts, and fitted with thumb-latch and bolt complete.

Provide and fix in privies inch deal seat and riser, with clamped flap and beaded frame. Provide and fix ¾-inch deal skirting round seat 4 inches wide; cut hole in seat for handle in cock for supply of water to soil-pan.

Provide and fix a hinged door to ash-pit hole 2 feet square.

Provide and fix in gable of roof a proper oak frame, grooved at 45 degrees angle, to receive luffer boarding fitted in ditto, and ornamented with a wave line. (See detail drawing.)

Provide and fix in bedroom ceiling a small sliding trap-door, with frame rounded and grooved to receive the same, to facilitate ventilation.

Plasterer.—Render two coats, float and set all the walls internally, and lath-plaster two coats; float and set the partitions throughout, and colour the same in kitchen and scullery. Lath-plaster, float, and set all the ceiling, and twice lime-white the same.

Paper-hanger.—Query—(A neat light paper in sitting-rooms and bedrooms much recommended.)

Painter.—To stain and varnish the whole of the wood-work; except in living-room, to be painted of a suitable light colour. The back-door to yard, and door to ash-pit and privy, to be painted a light green internally and externally.

Glazier.—The whole of the sashes to be glazed with diamond-shaped quarries of the best Newcastle crown glass.

Provide and fix in window of bedroom and children's room LOCHEAD's perforated glass near top, to admit fresh air, the perforations to be angular, and so placed as to throw the air towards ceiling. Provide and fix the same to top of cellar window.

Plumber.—To provide to sink in scullery a 2-inch iron waste-pipe into drain, with proper trap and grating complete.

To lead 1-inch lead pipe from bottom of rain-water tank filtering department to scullery, near end of slop-stone or sink, and 15 inches above it, to allow utensil to be placed beneath to withdraw water. (See notes on Filters.) Also same size pipe from unfiltered department of cistern to seat of water-closet, and provided with stop-cock to flush soil-pan with; to lead inch pipe from wash-stand basins in bedrooms to back of soil-pan in water-closet, using at each stand, beneath basin, a simple trap to prevent ascent of foul air.

To lay the valleys of roof with 5-lb. lead, to turn up at least 7 inches under the slates on each side, and properly secured. Provide and fix 5-lb. lead flushing to chimneys and gables wherever requisite.

Provide and fix to roof proper zinc gutters on iron brackets with cistern heads of neat design, and pipes complete, leading to unfiltered department of rain-water tank.

Provide and fix ventilating zinc syphon tubes for ventilation of rooms where required.

Provide and fix circular valves to apertures in living-room and kitchen, for regulating supply of air from warm-air chambers, (as described in fig. 55, p. 211, No. xxxv.)

Provide and fix perforated zinc plate with moulded edge to all ventilating apertures near ceiling.

Provide and fix iron wash-hand basins, lined with glass, with stopper and chain complete, with trap connected with pipe leading to water-closet soil-pan.

***Smith.*—Provide and fix wrought-iron chimney bars 2¼ by ½ inch, 1-inch camber running through all the jambs to fireplaces on basement.**

Provide grating to cellar windows, also to all air-flues at external walls.

Provide bow-latch spring shutter bars to all the shutters.

Provide and fix, if required, a boiler at back of fireplace in kitchen, to supply neat pedestal-tube in bedrooms with warm water, with feed and return pipes complete. (See p. 330, No. xxxvii.)

In Plate I. we give drawings illustrative of the external design of a pair of cottages, of which, in fig. 100, we show the ground-

Fig. 100.

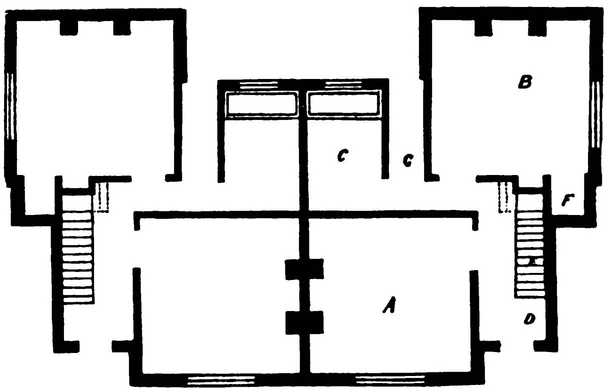
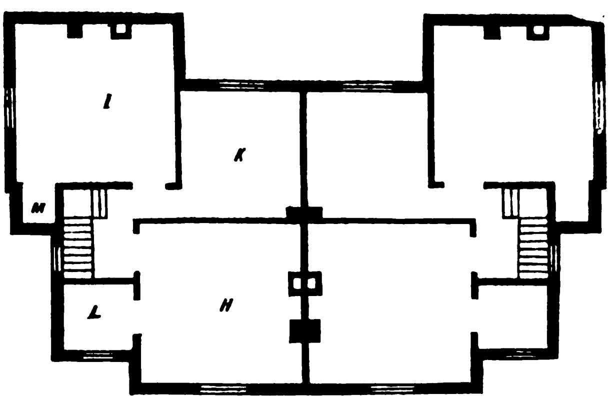


Fig. 101.



plan drawn to a scale of one-sixteenth of an inch to the foot; in fig. 101, a chamber plan; in fig. 102 a cellar plan; and in fig. 103* a plan showing outbuildings, &c.

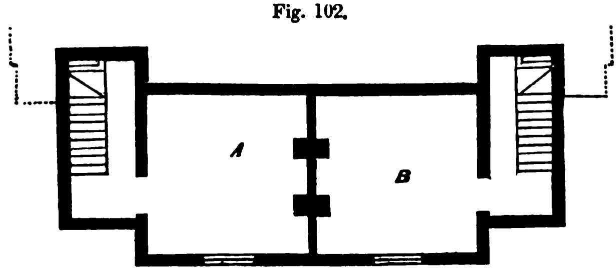
* **Fig. 103 will be given in next number.**

In the ground-plan, fig. 100, *A*, the living-room, is 13 feet 6 inches by 13 feet 6 inches, lighted by a three-light window; kitchen, *B*, same size, having a china closet, *F*, entering from it, 3 feet 3 inches by 3 feet, and a small cupboard, as in drawing; scullery, *c*, 10 feet 6 inches by 6 feet 3 inches, is lighted by a sash-window at back. The entrance-lobby, *D*, is 6 feet wide, the stairs, *E*, being 2 feet 6 inches. Entrance is gained to back-yard by passage *G*, 3 feet wide.

In the chamber floor, fig. 101, the front bedroom, *H*, is same dimensions as sitting-room below, and is lighted by a two-light window. The back bedroom, *I*, is of same size as kitchen, and has a linen closet, *M*, entering from it. The small or children's bedroom, *K*, is 10 feet 6 inches by 9 feet 7. A bath or store-room, *L*, 6 feet by 5 feet 6 inches, is entered from front bedroom.

In the cellar, *A* is the store-room, fig. 102, same dimensions as

Fig. 102.



sitting-room above. In the plan showing outbuildings, fig. 103, is the water-closet, the ash-pit, the tub-shed, the hen-roost, and the place for coals.

In the arrangement of these cottages some suggestive hints are thrown out worthy of consideration. The nature of the fittings, external and internal, will be gathered from the following description or specification:—

SPECIFICATION of Sundry Works to be done in erecting two Cottages for ——— ———, in the parish of ———, according to accompanying Drawings, Plate I., with figs. 100 *to* 103 *inclusive.*

Excavator.—To dig out the ground for the cellars, footings, drains, and cesspools, and dig out the ground under all rooms on ground floor, not having cellars under them, to the depth of 18 inches under floor. Fill in, ram, aud well consolidate the ground to all foundations, and remove all superfluous earth and rubbish.

Bricklayer.—The whole of the external and party walls to be carried up to the several heights and thicknesses shown in the plans and section, and to be composed of the best sound, hard, well-burnt stocks. The mortar to be of one-third well-burnt stone-lime, and two-thirds of clean sharp river or other approved sand. Lay a course of Countess slates, bedded in cement, round the whole of the external walls, at the top of the footings, to prevent damp rising. The fronts above ground-line to be faced with white Suffolk bricks, of a uniform colour, and finished with a neat trowel joint. The drains generally to be 4-inch glazed conical tubes, laid to as great a fall to liquid-manure tank as can be obtained, and well trapped at entrances and exit;

the whole to communicate with manure-tank at back of yard-well, 6 feet diameter and 7 feet deep, to be properly lined and domed over in brick-work, and to have a man-hole, covered with a slab of Yorkshire stone. Turn 9-inch relieving arches over all lintels and openings, and form all fireplaces with camber arches over the same, and trimmed arches where required for front hearths. Carefully gather in the chimney-throats, and carry up the flues, as described in specification of last house, (the fireplaces to be fitted as there described.) Form all necessary core for plastering externally, such as drip mouldings, &c. of 2-inch rough York core. Bed in mortar all bond timber, plates, lintels, wood, bricks, templates, and other work requiring to be set in the brick-work ; and bed and point round all window and door frames ; and back up and fill with solid brick-work all stone or iron work requiring it ; and properly set copper and grates with fire-bricks. Construct cistern ove rwater-closet and ash-pit of each house, in 9 inch brickwork, lined with slate, glass slabs, or gutta percha, or deal-board ; external dimensions 9 feet 9 inches by 4 feet 2 inches, and 5 feet deep. Pavement of kitchen, privies, &c., to be as in last house, or as desired.

Mason.—Put to the external doors tooled solid York steps, mortised to relieve door-posts. Put in the windows York quarry worked sills, 9 inches by 4 inches, weathered and throated, and 4 inches longer than their respective openings. Provide and fix to sitting-room an enamelled slate chimney-piece, and to kitchen a plain rubbed Portland mantel, jambs, and shelf. The fireplace on chamber floor to be fitted with a rubbed Portland box chimney-piece. Provide and fix in scullery a 6-inch tooled York slop-stone, on proper brick bearers. Provide and fix in beer-cellar two tier of York stone shelves on brick bearers, and 2-inch meat-stone in cellar.

Carpenter and Joiner.—The whole of the timbers to be used to be good, sound, well-grown Baltic, Riga, or Memel fir, well seasoned, and free from sap, shakes, or unsound knots. No timbers to be fixed more than 12 inches apart, or to take a less bearing than 4½ inches on the walls. Provide all necessary wood-bricks, 2 feet apart, to doors and windows, with all requisite preparation for fixing joinery. Provide and fix good sound fir lintels over every door and window opening, to have a vertical depth of 1¼ inch for every foot of opening, and a bearing of at least 14 inches at each end beyond width of same. The joists in sitting-room on ground-floor to be 7 × 2, trimmers 7 × 3, wall-plates 4 × 2½, properly spiked at angles, and returned. The joists to have one row of herring-bone strutting, and properly trimmed for fire-place. The joists to basement to be of fir 4 × 2, on oak sleepers, 4 × 2, properly bedded on brick piers, brought up to receive same. Lay both floors with 1-inch yellow deal straight joint floor. Frame and fix the quarter partitions on this story with beads and sills, 4 × 3 ; posts, 4 × 4 ; quarters and braces, 4 × 2. The sashes on ground-floor to be of deal, with chamfer-moulded mullions and transoms, and to be glazed with crown-glass set in metal frames to the mullions, which are to be rebated to receive same. The shutters to sitting-room to be 1¼ deal moulded, bead butt, hung with 2½ butts, and to have 1-inch deal back-flaps, to be furnished with brass shutter-knobs and bow-latch for fasteners. The boxing to have 1¼ deal proper boxing grounds, and ¾ deal return linings, 1¼-inch moulded backs, elbows, and soffits. The windows in kitchen and scullery to have 1-inch deal moulded linings and window-board, and 1¼-inch deal clamped folding-shutters, hung with hinges, and fastened with bow-latch bar.

The external door is to be of 2-inch deal, 4-panel moulded both sides, hung with 4-inch butts, and screwed to fir rebated and beaded frame. Provide and fix over door in frame a moulded fan-light, glazed with polished sheet-glass, and fix round the inside of frame ¾ deal-wrought and stuff-beaded linings.

The door to sitting-room to be 1½ deal, 4-panel, moulded both sides, hung with 3-inch butts to 1¼ deal wrought and rebated jamb-linings, and 6-inch moulded architrave. Provide and fix a brass mortice lock and brass furniture to this door. The doors to kitchen, scullery, &c., to be 1½ deal, 4-panel square, hung with 3-inch butts, to wrought and rounded jamb linings, and fastened with iron rim locks. The back-doors to be of 1½ deal, beaded and ledged, hung with hinges to solid wrought and rebated fir frame, fastened with latch and panel bolts, to have weather-board and bracket, and water-bar at bottom complete. Provide and fix in sitting-room ¾ deal moulded skirting to ¾ deal narrow ground ; ¾ reeded skirting to lobby, and square skirting to kitchen and scullery. The stairs to have 1-inch deal risers and 1¼ deal treads, on proper carriages, with rounded nosings, 1¼-inch strings, deal-framed and turned newels, and square box balusters, and elliptical hand-rail. Provide and fix,

kitchen, a drawer, to have 1½ deal ploughed and feather-tongued dresser-top, with 3-inch deal framed legs, 1¼ deal framed rails and end boards, and 1-inch deal back, and plugs to fix to ; 2 drawers with 1-inch deal fronts, return beaded ; ⅝ deal rims, and ½-inch bottoms, with sliders and runners ; fit the same with knob handles, and proper drawer locks and keys ; ¾ deal pot-board, and bearers ¾ deal skirting ; ¾ deal cut standards, and 2 tier of sunk plate-shelves and plate fillet. The closet in kitchen to have 1-inch deal 4-panel door, hung to rounded lining with 2-inch butt, and to have turn-buckle fasteners and cupboard locks, and to have three tier of 1-inch deal shelves in the inside.

The floors in chamber storey to be of same description as sitting-room floor. The sashes to be of the same description also, with the exception of the shutters, &c.; they are to have 1-inch deal framed and beaded grounds, and mouldings, 3-inch girt, to form architraves, and brought down to stop on 1¼ deal wrought and rounded window-board. The doors throughout on this storey to be 1¼-inch deal, 4-panel square framed, hung with 2½ butts, to 1¼ deal wrought, rebated, and rounded jamb linings, and to be fitted with iron rim locks and bolts complete. Provide and fix to closet in bedroom 1-inch deal 4-panel door, hung with 2-inch butts to rounded linings, and fastened with turn-buckle and lock ; fit the interior with three tier of shelves on proper bearers. Provide and fix round rooms ¾ narrow grounds and ¾ deal square skirting ; and narrow grounds and 1-inch deal square skirting to passage and landings. The water-closet in yard to have 1-inch deal seat and riser on proper bearers, clamped flap, and beaded frame, and to have a 1-inch deal proper ledged door hung with 2½ butts to wrought, rebated, and rounded linings, and fastened with latch and panel bolt. All other doors in yard, where required, to be of same description as door to water-closet.

Plasterer.—The whole of the dressings to doors and windows, chimney-shafts, and all exterior ornament to be executed in Atkinson or other approved cement, care to be taken that all arrises, quirks, metres, &c., be worked clean, sharp, and true, and the whole jointed and tinted (if requisite) to imitate stone. Internally render two coats, float and set the walls, and lath and plaster two coats, and float and set the partitions of the ground and chamber storeys, and colour the walls of kitchen and scullery a stone colour. Lath-plaster, float, set, and white the ceilings generally ; and run a plain cornice 12 inches girt round sitting-room, lobby, and staircase. All arrises to be properly plumbed and formed straight, and all quirks cut.

Paperhanger.—The ground-floor sitting-room to be papered with a paper of light margin, of the value of per yard. The lobby and staircase in imitation granite paper, hung in block, and the bedrooms with a paper of light colours, of the value of per yard.

Painter.—All the wood-work usually painted to be four oils in good oil colour ; the wood-work in sitting-room to be finished in party-colour, either in fawn, drab, or French grey. The front entrance-door to be grained wainscoat and twice varnished.

Slater.—Cover the whole of the roof with the best Countess slate, lined to a proper gauge, in ¾-inch battens, and nailed with zinc nails, and to have proper eaves-boards, tilting pieces, &c., complete.

Plumber.—The slop-stone in scullery to have a 2-inch iron waste-pipe leading to drain, well trapped, with brass grating complete ; and ¾ service-pipe, with bib-cock complete, from filtered department of cistern. The ridges to roofs to be covered with lead of 5 lb., 12 inches wide, and properly dressed down and fastened to ridge roll. The valleys to be laid with 5-lb. lead, and to turn up under slates at least 7 inches on each side, and properly secured. The flushings and chimney shafts to be of 5-lb. lead, 5 inches wide, turned into joints of brickwork, and fastened with wire hooks. Provide and fix to water-closets a common white soil-pan, with stop-crane and pipe leading from unfiltered department of cistern.

Smith.—Wrought-iron chimney bars 2½ × ½ inch, to be 1-inch camber, running all through the jambs, to be fixed to all the ground-floor chimney openings. Bow-latch spring, shutter, bars, to all the shutters ; four cast-iron air-bricks to be provided and fixed in each house under line of ground-floor at back. Provide and fix to eaves of both houses a run of proper zinc eaves-gutters on iron brackets, to empty in cistern-heads of rain-water pipes, with the requisite arms, elbows, shoes, pipes, &c., complete. Knocker and scraper to be fixed to each house. Provide and fix all necessary bells, cranks, and wires, and all necessary stoves, fireplaces, &c., complete. Provide and fix a cast-iron ornamental railing to front of house, properly fixed to a cast-iron curb, with gate lock and fastening complete.

THE FARMERS' NOTE-BOOK—NO. XXXVII.

Lime: its Chemical Agency. By J. Towers, Agr. Chem., M.S.A.S., &c.—So much has been, and continues to be, written upon this subject in reference to agriculture, that it might appear superfluous to offer one single additional remark. But the fact that opinions not only differ, but are conflicting, may, perhaps, fully justify the present attempt, especially as one of the principal, if not the most important, offices of lime, *(pure and caustic,)* has seldom been adequately noticed.

Some years ago, a periodical, *(The British Farmers' Magazine,)* first edited by the late Rev. Henry Berry, contained a trustworthy article by Mr Thomas Rowlandson, wherein it was shown, and proved by a number of perfectly conclusive experiments, that pure lime, either air or water slaked, ever exerted a *specific* and paramount agency upon the substances known by the terms of humus and humic acid. As those experiments were so clearly defined, as to leave no doubt of the facility with which they could be repeated and enlarged, I resolved to satisfy myself on the subject, and made a variety of trials, which more than confirmed all that had been stated by Mr Rowlandson. The magazine, after passing into other hands after the decease of Mr Berry, was discontinued in 1845, and cannot be referred to; but by describing some of the experiments which I undertook, those readers who take interest in the development of truth may soon convince themselves that Mr Rowlandson had, eight years since, done more justice to the true theory of liming than any writer before or since the period when he gave publicity to his discovery.

In order to pave the way for a clear perception of the exceeding value of Mr Rowlandson's experiments, I must recall to the reader's memory the period when the theory of *humus* was first brought into general notice. Some eighteen or twenty years since, the pages of agricultural numbers were crowded with articles upon that peculiar product of vegetable decay which then bore the name of *humine*; and soon after that period, the second volume of the *Penny Cyclopædia* contained, under the article on "Arable Land," several paragraphs, at p. 221-2, which clearly set forth all that was then considered the sound and philosophic hypothesis of vegetable growth and nutrition. By extracting the substance of these paragraphs, we shall ascertain the progress of the humic theory—the practice of *liming* as thereon depending, and as rectified by Mr Rowlandson—and finally, obtain a glimpse of the view announced by Liebig in the first edition of his *Chemistry of Agriculture.*

There are some soils which, besides a proper mixture of earths, contain a large proportion of a *natural manure* which renders them fertile. This is a substance produced by the slow decay of animal and vegetable matter. It has been called *vegetable*

mould, but as the term is not very distinct, we shall, after Thaer, and other eminent writers on agriculture, adopt the name of *humus*—a dark, unctuous, friable substance, nearly uniform in appearance: it is a compound of oxygen, hydrogen, carbon, and nitrogen. It is the result of the slow decomposition of organic matter in the earth, and is found in greatest abundance in rich garden mould, or old neglected dunghills. It is the product of organic power, such as cannot be compounded *chemically*.

Humus is the product of living matter, and *the source of it*. It affords food to organisation. Without it, nothing material can have life. The greater the number of living creatures, the more humus is formed; and the more humus, the greater the supply of nourishment and life. Every organic being in life adds to itself the raw materials of nature, and forms humus, which increases as men, animals, and plants increase in any portion of the earth. It is diminished by the processes of vegetation, and wasted by being carried into the ocean by waters; or it is carried into the atmosphere by the agency of the oxygen of the air, which converts it into gaseous matter. —THAER.

Humus, in the state in which it is usually found in the earth, is not soluble in water; but here the admirable provision of Nature may be observed. Humus is insoluble and antiseptic; it resists further decomposition in itself, and in other substances in contact with it. It remains for a long time in the earth unimpaired; but no sooner is it brought into contact with the atmosphere by cultivation than an action begins. *Part of its carbon uniting with the oxygen of the atmosphere, produces carbonic acid, which the green parts readily absorb.* (See Liebig thus anticipated—fourth edition, p. 100.) While its hydrogen forms water with the same, without which plants cannot live, the residue becomes a *notable extract, and in that state is taken up readily* by the fibres of the roots. But the changes still go on: the extract absorbs more oxygen, and becomes once more insoluble in the form of a film, which Fourcroy calls vegetable albumen, and which contains a small portion of nitrogen, readily accounted for. By bringing fresh portions of humus to the surface, and permitting the access of air to it, more carbonic acid, water, extract, and albumen are formed, and give a regular supply to plants, which, by their living powers, produce the various substances found in the vegetable kingdom of nature.

The passages in italic type will claim particular attention, so far as they bear upon the theory of Liebig. The last of them, which refers to the production of vegetable albuminous extract, must, however, be received with caution, as being purely hypothetical—published at a time when the chemical nature of humus had not been ascertained and clearly defined. This I hope will be proved by a recital of the experiments which were undertaken with a view to establish the facts propounded by Mr Rowlandson. If the reader will adopt the following simple processes, he will be abundantly satisfied on two important chemical results. Assuming, for the type of all those brown humic fluids termed *liquid manure*, the *deep coloured drainage* that runs to waste from a farm-yard, prepare a variety of solutions of old manure, sheep dung, black peat, rotten wood-earth, rich garden mould glutted with manure, &c.—first in *boiling rain-water* separately—and each will yield a brown liquid of a certain intensity. Set these apart, to deposit their sediment and become clear. In the mean time, add a few grains of carbonate of potash and carbonate (*i. e.* crystals) of soda to two separate pints of hot rain-water, and about a fluid drachm of strong liquor of ammonia (*Liquor ammoniæ fortis* of the shops) to an equal bulk of cold rain-water. These quantities are not arbitrary, as the operator may make each or all more or less strong according to the results. He may also try all and each of the alkaline solutions upon each of the five humic substances above

named; as, by so doing, he will acquire a comparative knowledge of at least twelve different products. *One certain* effect will follow the addition of any, or of all, the humous matters separately, to any one of, or of all, the alkaline liquids in detail—namely, a greater intensity of the brown tint; for, be the fluid alkali what it may—whether that of potash, soda, or ammonia—it will form a brown *humate*, by combining with the humic acid which exists in the spit-dung, peat-mould, wood-earth, or rich garden soil, &c., approaching in colour to that of farm-yard drainage. It will be seen also that the liquid manures so produced will retain their fluidity, and become bright by deposition, or be rendered so by filtration through white blotting-paper.

Having effected and carefully *noted* the results, be they more or less numerous, the next process will be the most important, as it is the foundation upon which rests the entire truth and value of Mr Rowlandson's hypothesis, and the veracity of all that I have adduced in proof of that specific action which quicklime exerts upon land redundantly surcharged with humous matter.

I have said little or nothing of the supposed agricultural uses of lime, and shall defer the consideration of them till I have solved the problem now under investigation. To effect this, it will only be needful to reduce to fine powder, by trituration, about half an ounce of perfectly burnt lime, and to prepare a small quantity of fully saturated lime-water. Here we may appeal to Professor Way of London, by quoting the following lines from an article on *lime* by that analytic chemist:—

Carbonate of lime (*chalk*) is insoluble, or only very slightly soluble in pure water. On the other hand, the hydrate of lime is soluble in considerable quantity, although to a far less extent than most substances. The quantity of lime which water will take up is dependent upon temperature—and it is a singular circumstance that the solubility diminishes with the increasing temperature: thus, one grain of lime is dissolved

At 60° of Fahrenheit, by 778 grains of water;
At 212° of Fahrenheit, by 1270 grains of water.

Or, in other words, the solubility is nearly twice as great at ordinary temperatures as at the boiling point of water. *Lime-water* is made by digesting an excess of *slaked* lime in cold water, which soon becomes saturated with it.

I have cited this passage in order, by such an authority, to correct the notion that, by using boiling water, more lime will be dissolved; and also to afford opportunity for observing that boiling water can be of no use, excepting only in the case of the lumps or shells of lime proving refractory, in consequence of age or insufficient burning in the kiln. When, therefore, in slaking lime, (that is, in bringing it to the condition of *hydrate*,) a lump of lime will not fall to powder in a few minutes after being simply dipped in cold water, a little quantity at boiling heat will speedily produce the desired effect. *Hydrate of lime*, properly made, contains rather more water than one-third of the original weight of pure lime: it is *slaked*, but not carbonated, and therefore will act with as much or more chemical energy than powdered lime hot from the kiln.

In preparing *lime-water*, a stopper-bottle should be employed, to guard against access of air, which always contains carbonic acid. After due agitation two or three times, at intervals, one ounce of fresh slaked hydrate, in a pint measure of the coldest water, will make a quantity of strong clear lime-water, quite sufficient for twenty or thirty experiments upon every variety of liquid humic manures that can be expected to come under the observation of a farmer or gardener.

I have said that humic acid will unite chemically with any of the three alkalies, and produce a clear brown liquid; and now, having, we will suppose, a number of such solutions, let one ounce, made by each of these alkalies, be put into a wine-glass. Drop into one of the glasses a little of the lime-water—say ten distinct drops into the humate of potash—stir the contents with a thin strip of glass, and observe the results: the liquid humate and the lime-water are presumed to have been bright, and free from any particles; when united they cease to be so; turbidity takes place, dingy grey flocks separate, are deposited, and the floating liquid is left nearly colourless. Treat the soda humate in a similar manner, then the one with an ammoniacal base, and both will equally respond to the solution of lime. The flocky substances are humate of lime: the lime, small in quantity as it is, exerts an attractive affinity for the humic acid, stronger than that of any of the true alkalies.

Vary the experiment by employing the clear brown sewage from a dunghill—which we will presume to be a humate of ammonia and potash—and the lime-water will produce similar effects.

If, instead of lime-water, a few grains of powdered lime, or the slaked hydrate, be stirred into each glass of the brown fluid, the same decoloration will take place, and grey flocks intermixed with the superabundant lime will subside. Again, if a little of the dry lime be mixed with any of the humus substances first named, boiling rain-water may be poured upon the mass in a cup without extracting any colour—the lime having attracted and fixed the acid ingredient, liberating the alkaline base with which it might be united. Thus, it has happened occasionally, that while mixing quick-lime with an ounce or more of rich spit-dung, ammoniacal gas has been liberated, and detected by the smell, or by inserting a strip of glass moistened with spirits of salt (muriatic acid) over the mixture.

Enough has been advanced to enable the chemical student to go through and vary a course of experiments, amounting to a dozen or fifteen, every one of which will prove that hot, or fresh hydrate of, lime is a specific power, by which humus matter, if redundant and noxious, can be overcome and fixed as an insoluble *humate of lime*; or one which, if not absolutely insoluble, can only be acted upon by moisture so slowly, as to become a safe and perhaps salutary ingredient of the soil.

Mr Rowlandson's experiments, one and all, pointed in the same

direction. I followed in his wake, and established his every position, endeavouring to communicate the facts as they became more and more irrefragable, while always vouching his priority.

From what has been stated—the accuracy (as to facts) of which any chemical tyro may convince himself by a few almost costless processes—I think we may propose a theory of agricultural liming which cannot perplex or mislead. *First*, then, if pure or fresh slaked lime meet with humus matter in the ground, it will infallibly combine with the principle called humic acid to an extent equivalent to its combining and neutralising capability; and this by the force of a specific affinity so paramount as to attract that substance from any of three alkalies with which it may have been united. If humus matter superabound, as in turbaries, peat bogs, or old ground glutted with it, lime, if in sufficient quantity, will act remedially, reclaim the land, and bring it to a healthy condition.

Secondly, Lime can and will decompose fresh vegetable and animal matter, and so far prevent the formation of real humus.

And now, claiming the admission of these leading principles, it remains to take a cursory glance of those other properties which have by writers been ascribed to lime.

Every one who is acquainted with Sir J. Sinclair's "*Code*," must be aware of the great liberality with which lime-shells were applied in Scotch husbandry. Our quotations will be given from a work now in progress, and therefore quite modern. Alluding to the beginning of the nineteenth century, a few years before Sir H. Davy delivered his chemical lectures before the *Board of Agriculture*, it is stated that—

> The great topic of discussion, both among practical and scientific farmers, was the part which lime played in relation to the soil, and to those crops which were most benefited by its application. Some contended that lime was not of itself a necessary part of the food of plants; others concluded that not only did it convert inert substances into available material for supporting vegetation, but that it was itself a necessary and essential constituent in the food of plants. *Modern analysis of the ashes of plants*, and the composition of soils, have proved the latter theory to be correct.
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> In Northumberland, Durham, and part of Yorkshire, presuming the application of a first heavy dose—as 200 or 300 bushels per acre on *cold clay soils*—the custom once was "to bind the tenant to apply so much lime at every rotation, whether it required it or not." Anything more pernicious could scarcely be devised, because of the utterly *exhausting* action of lime when not accompanied by a more than ordinary *generous* treatment of the soil. This repeated use of lime, without heavy manuring with farmyard dung, or continued pasturing for several years, forces the soil to yield up to the plants growing on it a larger amount of its more available resources, in a shorter time, than would be the case were no such repeated doses applied. Hence the origin of the old saying, that "Lime enriches the father, but beggars the son."

Lime, then, *exhausts* land. But how? The writer shall furnish *his own* reply shortly. In the mean time, it is to be hoped that enough has been advanced upon the specific power of lime to attract and fix, to the point of *saturation*, so much of the humic

matter that it meets with, either in the soil or in the putrescent manures applied as a fertiliser. It appears to me to be unphilosophical to introduce antagonistic agents into land at the same time. It is admitted that "*there are cases* in which liming land every rotation is profitable;" one of which—"a cold clay land in Scotland"—is cited, "and is merely given as an illustration that lime may be frequently applied with advantage on stiff clay soils, where there is a copious command of farmyard dung. In this instance the vegetable and animal manure, (applied twice, heavily, every rotation of seven years,) was in excess, and required *the aid of lime to bring it into action*"—we should rather say, to retard by neutralisation—and thus laying up a store of innocent humate of lime, ready to be appropriated according to the requirements of the several crops of the rotation. Again—

The crops most benefited by liming.—Here we are told that on no description of crop does lime seem to exercise so sudden and so permanent effects as on white clover and the rye-grasses, and also on the class known as natural grasses. In arable farming, where the land remains in pasture two or three years, the liberal use of lime or chalk is indispensable, in order to insure a thick sole of grass. Lime causes white clover and rye-grass to thicken and produce a closer sole every succeeding year that the land remains in pasture, until a complete sward is formed; whereas the want of it causes these grasses to die off, while their places are filled by the worst description of natural grass and weeds. The best indication to the farmer of light soils that he must begin to re-lime his land, is the appearance of *corn marigold* (*chrysanthemum segetum*,) general weediness of the surface when laid down to grass, and, above all, an increased tendency to run to couch-grass.

Lime is found to act in a remarkable degree on the turnip crop, particularly in the disease called fingers and toes, removing it altogether. Among the corn crops, barley seems to be the crop most benefited by the use of lime: the finest barley in the three kingdom is to be found growing in the chalk districts. Its effects upon oats and potatoes are considered to be arbitrary and uncertain, depending much upon the nature of the land; but leguminous plants of all kinds are greatly assisted by lime, whether beans, pease, or vetches, as it not only increases the bulk of straw, but also improves the quality of the grain. The leguminous fodder-plants, lucerne and saintfoin, unquestionably flourish better on chalky lands—as witness their luxuriance in the Isle of Thanet, and on inland chalk downs.

The effects of quick-lime upon slugs and moluscous vermin are familiarly known; but not sufficiently so, perhaps, is the fact that it ought to be applied liberally twice within a few hours of the night—that is, after 10 o'clock and before morning dawn. A farmer, known to the writer, told him that, finding his young corn much injured by shell-less slugs, but not being able to discern the enemy, it occurred to take his lantern and inspect his fields before he retired. Wherever the light fell, it discovered innumerable bright objects. He lost no time, roused his men, had horses put to the wooden rollers, and made them pass over

the crop—thus crushing the vermin by myriads. The best gardeners have also stated that, to effectually clear the gardens, a morning sprinkling is equally required as the one given after dusk.

It is not attempted to allude to all the objects for which the practice of liming has been recommended, nor even to touch upon the several methods of applying the lime to the land. It suffices to have referred to a few points which bear upon the specific agency of lime, which distinguishes it from any other stimulant or ameliorator. They who seek for clear and trustworthy remarks upon general liming, may find them in the *Book of the Farm*, vol. ii., (edit. 1851,) p. 665 *et seq.*—"On the liming of land." Before appealing to one paragraph, (No. 6022,) it will be but just to chemistry to glance now at the article "On Lime" by Mr Way, in *Morton's Cyclopædia of Agriculture.*

Freshly-burned lime is a highly caustic alkaline substance, rapidly disorganising and destroying any organic tissues with which it is brought in contact. The *precise nature of the chemical effect* which it produces in the soil has always been a subject of much uncertainty and dispute. It is common to refer to this substance, when used as a manure, the office of performing all those various changes which it is known to possess the power of effecting *out* of the soil. Thus, lime is said to act by causing the *decomposition* of *vegetable mould* or *humus*, which is insoluble, and inducing it to enter into union with oxygen, giving *rise to humic acid*;—which latter, of course, would unite with the lime to form *soluble* humates; and if we suppose these *salts* to be capable of yielding nourishment of plants, we have at once a tangible reason for the advantage accruing from the use of lime.

Whatever may be the information which the man in research of truth may acquire by the study of the foregoing lines, certain it is that they do not convey the faintest idea of that specific action which, happily for agriculture, was discovered by Mr Rowlandson, fifteen years or more since, and candidly laid before the reading public in several faithful articles. How strange it is—how much to be lamented—that, notwithstanding the disclosure of phenomena, clear as the light, not the slightest notice appears to have been taken of them by any of the writers in the agricultural publications.

To recur to Mr Way—

Lime is believed to effect important changes in the mineral constituents of soils. Portions of granite and other rocks, from which clay has been originally formed, are still found in it, and are the source of potash, soda, magnesia, &c., to vegetation. These are decomposed by lime at a high temperature; and in course of time this substance will bring about the same results in the soil. In this way, time, by liberating alkaline substances, may produce a very marked effect, especially on such crops as are benefited by alkaline manures.

As to the direct action of lime as an element of food, Mr Way observes—

The addition of it to soils may, in rare cases, be important, as furnishing an actual element of the food of plants; but we believe that the researches which have been made on *the absorption of manure* by soils, will furnish the clue to much information on the subject of lime. There is no doubt that certain compounds exist in the soil,

which are capable of arresting and decomposing salts of ammonia and potash, and in a similar manner of retaining organic matters. The compounds either *contain lime*, or may be produced in larger quantity by its means; whilst, at the same time, its application separates the alkalies, &c., that have already been absorbed.

The professor is certainly correct in anticipating further discoveries connected with the phenomena of the undeviating liberation of lime, in some form or other, dissolved in the clear and colourless filtrate that passes from a body of soil which has attracted and fixed the ammonia and colouring organic matter of any liquid manure subjected to filtration through an earth that appears *to be free, or nearly free, from lime* as a component. More recent experiments, have, I believe, satisfied the chemist of the justness of his surmises. Thus, to the point,—If 8 ounces of a dark-coloured *ammoniacal* manure be filtrated by degrees through 2 lb. of dry earth, contained in a glass tubulated drainer, as formerly described by me—which earth is so destitute of carbonate of lime as scarcely to yield a frothy bead when tested with muriatic acid diluted by twice its quantity of water—the ammonia and colour, (*i.e.*, humate of ammonia,) will be seized by the soil, and the water that flows through will be nearly colourless, clear, and rendered so hard by chalky matter as to curdle a spirituous solution of soap. Now, it is evident that the ammonia must have acted chemically upon some cretaceous substance present in the soil, but so masked as not to be detected by a mineral acid. We thus re-approach the position which it was our purpose to substantiate; and shall proceed by calling the reader's attention to some of the views entertained by Sir H. Davy, as stated in his Seventh Agricultural Lecture—

When lime, whether freshly-burned or slaked, is mixed with any moist fibrous vegetable matter, there is a strong action between the lime and the vegetable matter, and they form a kind of compost together, of which a part is usually soluble in water. By this operation lime renders matter, which was before comparatively inert, nutritive; and as charcoal and oxygen abound in all vegetable matters, it becomes at the same time converted into carbonate of lime.

The solution of the question whether quick-lime ought to be applied to a soil, depends upon *the quantity of inert vegetable matter* that it contains. When a soil, deficient in calcarious matter, contains much *soluble* vegetable *manure*, the application of quick-lime should always be avoided, as it either tends to decompose the soluble matters by uniting with their carbon and oxygen, so as to become mild lime, or it combines with the soluble matters, and forms compounds having less attraction for water than the pure vegetable substances.

In other words, becoming more insoluble. Davy, it is evident, had seen and proved enough to demonstrate the attractive power of lime, but not to resolve the problem, the solution of which it remained for Mr Rowlandson to effect. Thus, at p. 290, he says—

I mixed a quantity of the brown soluble extract which was procured from sheep's dung, with five times its weight of quick-lime. I then moistened them with water; the mixture heated very much. It was suffered to remain fourteen hours, and was then acted on by six or seven times its bulk of pure water. The water, after being

passed through a filter, was evaporated to dryness ; the solid matter obtained was scarcely coloured, and was lime mixed with a little saline matter.

Here we have an experiment made by a youthful inquiring chemist. Had he employed one-fiftieth part of the lime, and made a far stronger and more deeply tinted liquid, procured by digesting the sheep manure in water holding in solution a little alkali of any kind, (as before stated,) he would have established two facts of great consequence to agriculture; but then he would have been far in advance of *his* period, and indeed, so far as I can perceive, generally of the present period also, with all our refined appliances.

In conclusion, I take the liberty to revert to the *Book of the Farm*, by quoting the paragraph No. 6022.

The effects of lime are manifested in a rather remarkable manner. When ploughed down with an ordinary furrow by itself, no effect is observed on the first crop ; and when it is ploughed in deep, a rotation may pass before it shows any effect. When harrowed in, and the land ribbed for barley, after turnips eaten off by sheep, it has its effect at once. When ploughed with a light furrow above the dung in summer-fallow, even after the lapse of a few weeks it has a sensible effect on the first crop. It has the best effect on the grass of any crop in the rotation, and most on the clover. It loses its effect on the same land after several repetitions. It has little effect on soils in the neighbourhood of large towns. It has an injurious effect on the potato crop. It has always a good effect on fresh soil, as also on moss that has been thoroughly drained. It has a good effect on all drained soils, and is wasted on undrained ones.

If the discerning cultivator reflect on all the above and other practical facts, and bring to bear upon them the paramount and specific agency of lime upon humous substances, a step in advance —we may rather say a great *stride*—will be taken in the progress of agricultural science.

Some crops that might be cultivated in Great Britain which are not commonly cultivated.—Whoever recommends the agriculturists of this country to cultivate a new crop, incurs a great responsibility ; and if his recommendation is attended by success, he receives great credit. We are neither presumptuous enough to venture upon the former, nor have we sufficient ambition to aim at the latter. Our object here is merely to enumerate certain crops that are grown on a large scale in other countries, but which are not cultivated by our farmers, or concerning which there appears to be sufficient evidence to warrant the possibility, at least, of their successful introduction.

Mangold-wurzel is in England now extensively cultivated for the purpose of feeding cattle. It is not much grown in Scotland, as turnips are found here to afford in general a greater amount of food per acre. On the Continent it is grown for the sake of extracting sugar from it ; and, did the law permit it, it might be profitably grown for this purpose in this country, and also for making beer and ale.

From the official documents of the French Government, we learn

that the usual average of a beet crop is about 10½ tons an acre. Each cwt. yields 4¾ lb. of sugar; and, accordingly, the produce per acre would be nearly half a ton of sugar. Boussingault found that, to manage an English acre of land under beet-root, 45½ days of a man and 14 days of a horse was the amount of labour expended.

The expense of obtaining the sugar from the beet is, however, very great. The roots are washed and rasped, and then subjected to strong pressure; the juice is boiled, filtered through animal charcoal, and boiled until it is sufficiently reduced. But owing to the improvements made in the machinery, the cost of separating the sugar has been very much lessened; and it is now affirmed that a farmer here might grow beet and separate the sugar, leaving himself a profit, and yet sell the sugar at 2½d. per lb.

Beet-root may be substituted for malt in brewing; and supposing the above calculation to be correct, it is probable that a gallon of beet-root beer, of the strength of ordinary table beer, could be made for about 2d. Did the law allow it, and were it considered advisable, a spirit might be distilled from this.

In making sugar from beet, the residue is employed for feeding cattle.

Tobacco is forbidden to be grown in Britain by the excise laws. Indeed, tobacco of the finest quality cannot be produced in this climate; and tobacco grown in Europe, or even Virginia, cannot be compared with that of the Havannah and Varinas. Still, the plant does succeed in this country, and tobacco of ordinary quality might be grown here. About 12 cwt. per acre is a common crop; and more could probably, by good farming, be attained. It would therefore appear that tobacco would be a profitable crop.

Tea is an article for which there is an immense demand, and which, from its passing through so many hands, and its long transit, sells at a price that would doubtless very handsomely remunerate the producer of it in this country, provided it were possible to produce it. And there seems reason to believe that the green-tea plant might be acclimatised. Perhaps the best plan would be to procure seed from the north of China and Japan, in which place, we believe, the cold of winter is more intense than here. Certainly, if the tea plant could stand our winters, it would be a very profitable crop. Each plant produces about 2 lb. of tea annually; and the plants are planted from 3 to 6 feet apart. When it is considered that tea sells for nearly 3s. a lb., the money return per acre (supposing these statements are correct) seems enormous. The expense of preparing the tea for the market does not seem to be great. It is hand-picked, and (in Brazil) immediately dried. "From 4 to 6 lb. are thrown into an iron pot, the interior of which is polished, and which may be somewhat more than 3 feet in diameter, by about a foot in depth. The temperature of the pot is maintained at about the boiling-

point of water. A negro stirs the leaves in all directions with his hands until they become quite soft and pliant, so that they can be moulded into pellets by movement between the hands. When the leaves are in this state they are thrown upon a tray made of bamboo, and strongly kneaded for a quarter of an hour, so as to force out a green sap of a disagreeable taste." They are then returned to the pot and dried.

Chicory is a plant that might probably be introduced into extensive cultivation. The powder of its ground root was originally used as an adulteration amongst coffee; but now the public have acquired a taste for the mixture, and prefer it to pure coffee. It is now openly and avowedly sold. It is found that a crop of from 12 to 15 tons can be obtained to the acre. The roots are sliced and kiln-dried, and the above weight is then found to be reduced to about 1 ton. This sells at from £15 to £23. The cost of labour, kiln-drying, &c., is about £5 a ton. Consequently for rent, manure, and profit, there is left a margin of from £10 to £18.

Oil-producing plants.—The rape is the only plant commonly cultivated by the British farmer on account of its oil. On the Continent several other plants are grown for this purpose, two or three of which might perhaps be advantageously introduced. The following table, quoted from Boussingault, shows the results of some experiments made by M. Gauzac of Dagny.

Crop.	Seed produced per acre.			Oil obtained per acre in lbs. avoirdupois.	Oil per cent.	Cake per cent.
Winter crops—	cwt.	qrs.	lb.			
Colewort,	19	0	15	875.4	40	54
Rocket,	15	1	3	320.8	18	73
Rape,	16	2	18	641.6	33	62
Swedish turnips,	15	1	25	595.8	33	62
Curled colewort,	16	2	18	641.6	33	62
Turnip cabbage,	13	3	19	565.4	33	61
Spring crops—						
Gold of pleasure,	17	1	16	545.8	27	72
Sunflower,	15	3	14	275.0	15	80
Flax,	15	1	25	385.0	22	69
White poppy,	10	1	18	560.8	46	52
Hemp,	7	3	21	229.0	25	70
Summer rape,	11	3	17	412.5	30	65

We do not know what plants he means by coleworts and turnip cabbage, but two of the plants mentioned in the above list, the gold of pleasure and the white poppy, and another oil-bearing plant, the Madia sativa, have perhaps a claim upon the consideration of the British agriculturist.

The gold of pleasure, or the Camelina sativa of botanists, is a

native of Britain; but whether it is indigenous, or has been accidently introduced from the Continent along with flax, is doubtful. At any rate, although a much esteemed cultivated plant of many other countries, it has never received much attention in Britain; and yet it is not easy to discover the reason of this. The gold of pleasure produces an oil for burning, which is considered to have less smoke and smell, and scarcely any of the latter, with a brighter flame than that obtained from the rapes. It yields a large quantity of oil to the acre, does well upon light soils, and occupies the ground for a short period, coming to maturity in the south of Europe twice in the season. Even here it may arrive at maturity in time for sowing grass seeds after it.

Besides affording oil, the gold of pleasure yields a fibre which does for thatching, sack-making, &c.

The white poppy is cultivated for the sake of its milky juice, which in its crude form affords us opium, and for the sake of the oil of its seeds. This oil is in this country mainly used for some purpose of the painter, but in many parts of the Continent it is very extensively employed as a substitute for butter. Very little English opium is made, but about 40,000 lb. are annually imported from Turkey, Constantinople, &c. This quantity, if grown at home, would require about seven hundred acres. The following is an account of the produce obtained from an acre of poppies. We have retained the value of the oil and oilcake, but they are greatly over-estimated.

56 lb. of opium, at 36s.,	£100	16	0
250 lb. of cold drawn oil, at 1s. 6d.,	18	15	0
125 lb. of warm do., at 6d.	3	2	6
500 oil-cakes, at 18s. per 100,	4	10	0
Total,	£127	3	6

The procuring of the opium, however, must be an expensive process. When the capsules are half grown, incisions are made into them, care being taken that the interior is not penetrated into. A white substance immediately flows out, which is collected by old women and children, by means of knives covered over with sealing-wax. This juice is scraped off into and stored up in jars. The seeds are not injured by this process, but come to maturity and have the oil extracted from them in the usual manner.

The poppy, in addition to its opium, extracts from the ground a larger quantity of oil than a cow can do. The average quantity of butter that a cow can produce, may perhaps be set down at 300 lb. per annum, and she will require an acre and a half of ground; whereas, in the experiment we have quoted, the poppy from that area yielded more than 370 lb. of oil. Still, for vegetable oils for culinary purposes, there is little taste in this country; and the demand for opium will, of course, always be limited. Hence we can scarcely expect to see any very extended culture of the poppy in this country.

The Madia sativa is the remaining plant of this group that seems to demand at least a modified attention in this country. It is sufficiently hardy, and would appear to be productive. Boussingault, now a dozen of years ago, planted it along with carrots in a well-dunged field. The crop took one hundred and twenty-seven days to come to maturity, and the following was the result:—

Seeds, husks deducted,	2424 lb.
Dried leaves used as litter,	7700 ,,
Carrots without their leaves,	31966 ,,

The seed gave—

Of oil,	635 lb.
Of cake,	17067 ,,

And 100 parts of the seed gave—

Of oil,	26.24 lb.
Of cake,	70.72 lb.
Of loss,	33.04 ,,
	100.

It is a curious fact, and illustrative of the imperfect manner in which the oil is separated from the seeds, that while the common pressman only obtained some 26¼ per cent, Boussingault, in his laboratory, from the same seeds actually procured 41 per cent. When the oil-cakes are meant for feeding, this loss is of little consequence, inasmuch as the oil serves a very good purpose; but when the cake is only intended to be used as a manure, it is a great loss, inasmuch as the oil is of little or no use in adding any food for crops to the soil.

There is a great lack of plants in this country cultivated for the sake of the *tannin* that they contain. As our readers are aware, the basis of the skin of animals is composed of a substance to which the name of gelatine is given. One of the properties of this substance is, that when combined with tannin it forms the compound of tannate of gelatine, or leather—a substance which is so useful to mankind. From time immemorial the substance employed to furnish the tannin to the hides of animals, in order to convert them into leather, has been oak bark. But as the purpose for which oaks are grown is their timber, and not their bark, the supply of oak bark cannot be calculated upon, and this is perhaps one of the causes why tanning as an art is in such a backward state. Could a plant abounding in the principle of tannin be grown on our fields, there can be little doubt but that it would be remunerative. Perhaps we possess or might possess such in—

The sumach, a species of which is the agent employed by the Turks in tanning. There does not seem to be any reason to believe that the common sumach would not be hardy enough for the climate of this country. Some other members of the genus might probably also come to sufficient maturity here.

It is possible, also, that we possess indigenous wild plants that contain a good deal of tannin, and which might perhaps be successfully cultivated.

There are two or three plants that might probably be advantageously cultivated in this country, for the sake of their *fibre*, besides flax and hemp. Perhaps the most important of these, ridiculous as the assertion seems, might be the *nettle*. At any rate, its claims have never been sufficiently considered. We leave the nettle, however, to its insignificance, and pass on to the enumeration of two plants that, were there a demand for cheap wine in this country, might perhaps be profitably grown in Britain, and their juice converted into wine. In order, however, to have clear ideas upon this point, it is perhaps necessary to recal to our memory the exact composition of wine.

Wine essentially consists in a mixture of alcohol, that has been produced by the fermentation of sugar, of tartaric acid, a peculiar ether, and, perhaps, other flavouring substances, the whole diluted with at least seventy-five per cent of water. Sugar is contained in a great many vegetable productions, and only differs in chemical composition from alcohol in each equivalent of it containing one atom more of carbon and two of oxygen. If we extract these last mentioned atoms from sugar, we have at once alcohol; and we produce this change artificially, by what is called the process of fermentation. In order that this process of fermentation shall take place, the sugar must be dissolved in water, the solution must be placed in a certain temperature, and to it a substance called ferment must be added. Two of the commonest of our ferments are gluten and yeast. When to a solution of sugar and water either of these are added, an intoxicating drink is produced. Then malt contains a large quantity of sugar; and if this be dissolved in water, and fermented by having yeast added to it, we have ale or beer. In like manner apples contain sugar, water, and gluten; and when apple juice is placed in a proper temperature, it ferments and forms cider. Wine, however, is not only an alcoholic drink obtained from the action of a ferment converting sugar into alcohol, but its alcohol and water essentially contain tartaric acid, ether, &c.

The grape contains water, sugar, gluten, and tartaric acid, and hence its juice ferments and is changed into a mixture of water, alcohol, and tartaric acid, and, by keeping, the formation of an ether is eventually brought about. Hence, in all ages, the fermented juice of the grape has been considered the type of wine; and the great consumption of it in this country, notwithstánding its high price, shows how very much a necessary of life it has become. Formerly, in the south of England, vineyards were common. It has been conjectured that their management was only known to the monks, and that they fell out of cultivation after the Reformation, because the farmers were ignorant of the proper culture of the plant. One or two, however, lingered on until our fathers' times, and we know that the wine that they produced resembled claret. Provided they would pay, there is nothing, to our certain

knowledge, to prevent the production of good wholesome wine in the south of England.

The expense of management in a vineyard is doubtless great, and we have not any data just now before us by which we could estimate it. The produce of one is more easily ascertained, and the following table indicates the wine obtained per acre from a vineyard in Flanders, in about the latitude of London, for 13 years. It was planted in 1822, and began to yield in 3 years.

Years.	Wine per acre in gallons.	Years.	Wine per acre in gallons.
1825	68.75	1832	209. 9
1826	192. 0	1833	311. 6
1827	0. 0	1834	413. 4
1828	115. 0	1835	620. 0
1829	55. 9	1836	544. 5
1830	0. 0	1837	184. 4
1831	153. 0		

The average quantity, per acre, of wine obtained yearly from this vineyard, is 224½ gallons, or 110 dozens. If the average of the last six years, however, when the vines had got fairly established, be taken, it would be considerably higher.

The vine, however, is a very uncertain crop. Unless it receive the exact amount of heat and light that it likes, it does not form a sufficient quantity of sugar; and the wine that is made from it is, of course, deficient in alcohol. The French, who are the best wine-makers in the world, have, however, found a remedy for this; and now, when the juice of the grape is deficient in sugar, they add as much sugar to it as will make up the deficiency;—and in this manner they secure the same strength of their wine each year, and are in a great measure independent of season. And by the aid of this fact, not only might a vintage be secured in the south of England each year, but wine might perhaps be made farther north than even was the case before.

There is a great deal of incredulity, first, upon the possibility of making wine at all in this country; and, secondly, upon the possibility of making good sound wine from unripe, or partially unripe, grapes. Besides the statement that wine used to be annually made in England, we may, regarding the first point, quote the experience of Mr Hamilton, who made champagne upon his property in England. "Many good judges of wine," he says, "thought it superior to the best champagne they ever drank, even the Duke de Mirepoix preferred it to any other wine; but such is the prejudice of most people to anything of English growth, that I generally found it prudent not to declare where it grew till after they had passed their verdict upon it. The surest proof that I can give of its excellence is that I sold it to wine merchants for 50 guineas a hogshead; and one wine merchant to whom I sold £500 worth at one time, assured me that he sold some of the best of it at 7s. 6d. to 10s. 6d. per bottle."

Upon the second point, we will state the authority of Dr Macculloch. "It has been fully proved," he writes, "that a compound of an artificial *must* can be fabricated from due mixture of sugar with the extractive matter and saline substances of fruits capable of undergoing a regular fermentation, and of forming good and perfect wine. Long ago, experiments were made in France, by several chemists, with green grapes and sugar, with complete success. I have repeated these experiments, and varied them, with the best effects. The produce is varied with the management, and the result of the trials has been wine resembling champagne, Grave, Rhenish, and Moselle; and of qualities so perfect, that the best judges and wine-tasters have not been able to distinguish them from foreign wines. The grapes may be used in any state, however immature."

One pound of sugar fermented affords as much alcohol as makes two bottles of a wine of the strength of champagne.

Considering all the above facts, and, moreover, the possibility, which we here leave out of the question, of other vegetable productions affording wine, there is a probability that the time may come when the British farmer, like the French one, will grow upon a part of his farm something that will be converted into wine.

Madder is a plant that can perhaps be grown to greater perfection in this country than anywhere else. We doubt, however, if it is grown at all; and yet it would appear to be a profitable crop. In Alsace it is propagated by using the sprouts that it throws out in spring, and which very readily strike. The soil is heavily manured and trenched, and the planting takes place in May. The roots are not ready for gathering until the second November following, and the crop is estimated to average about 3300 lb. per acre. This is equivalent to an annual crop of 1650 lb., or nearly 15 cwt. The price of madder fluctuates; but it is often, we fancy, £3 a cwt.

A number of *leguminous* plants might be cultivated in this country for the sake of their ripe seeds. The following table, copied from Schwertz, indicates the produce per acre, and the weight of a bushel of haricots, lentils, and vetches:—

	Weight of bushel in lb.	Produce per acre in bushels.	Weight of dry straw per acre.
Haricots, .	47.5	66.7	not stated
Lentils, .	62.3	39.8	do.
Vetches, .	62.3	41.2	2 tons 4 cwt. 2 qrs. 11 lb.

The Transactions of the Highland and Agricultural Society for July 1852 contain an essay on the cultivation of lentils, by M. Guillerez.

A still more valuable suggestion was recently made by Professor Voelcker, in his paper, in our pages, upon *Quinoa*. If, as seems very probable, this plant could ripen its seeds at a high elevation above the sea, many of our uncultivated mountains, now scarcely worth anything, might afford a due supply of grain.

Not only is the introduction of a new crop a source of direct profit to the farmer, but its good influence often extends further than this, and greatly improves agriculture. As instances of the truth of this, we may cite the introduction of clover and turnips.

The Straight Line and the Curve. By Mr David Gorrie, Annat Cottage, Errol.—Curious notions have been entertained regarding the comparative merits of the straight line and the curve. Some fields in the Carse of Gowrie are still laid out in curved ridges—a remnant of the time when oxen performed the work of horses. A Carse farmer once argued against these ridges on the point of beauty. He considered that straight ridges were the most beautiful; and in support of his opinion advanced the rather questionable proposition, that "nature never made a crooked line!" A contrary argument might have been urged on the other side, with fully as much propriety. But reasons of a more metaphysical nature have been advanced on this subject. All persons are not content simply to say, with certain of Repton's employers, "I love an avenue," or, "I hate an avenue." The author of a recently published nonsensical volume, which pretends to unveil a new, and the only true philosophy, uses the following language in describing how *sublimity* may be defined:—

There is nothing purposeless in nature, and hence no natural bias of the mind is purposeless. In the FORMS of things the mind has a bias towards CURVES. But why? There are many reasons. I will mention one. Man cannot comprehend infinity; nor can he derive pleasure from what he cannot comprehend. A straight line has in it the *principle* of infinitude: unbroken, it is infinite. The mind strives to grasp it, and is repulsed. There is more of awe than pleasure in this repulse. From its interminable vastness, we cannot take in the thought: we are doomed to joyless ignorance. The emotion we experience is Sublimity. Whatever awakens the feeling, or impresses us with the idea of undefined or defineless immensity, is sublime. Of this the straight line is suggestive; hence it affords the mind less satisfaction than the curve; and for this reason—the mind *can* comprehend the circle. No matter how immense it be, the mind can travel round it. The process is easy. There is something cut out from space; something we can comprehend and KNOW. This is the source and purpose of the bias. Every natural bias of the mind has the same tendency;—it yearns to KNOW.

There may be an argument here in support of the author's theory, that knowledge, or what he calls intelligence, is the only good; that there is no such a thing as evil, and that what we call sin is only the result of ignorance. Without referring further to the theory propounded in his book—a book ill fitted to attain its object of bringing round the Millennial age—it may be allowable to inquire in how far the principle expounded in the above extract has a bearing on the art of ornamental gardening; for certainly it would seem to indicate that landscape-gardeners have hitherto, in some things, been acting from false motives. We have been accustomed to consider that no landscape can be really pleasing that does not possess what is called *continuity*. This principle enters into every pleasing landscape, and into every pleasing

painting. And can it then be true, that the feeling incited by the continuous and the infinite is only that of the joyless and painful sublime? It may be well to seek a settlement of this point before saying anything further about the straight line and the curve. And it may be best to begin by citing the authority of at least one painter and one landscape-gardener.

A certain painter, whose name carries weight, embodied a prison-scene on his canvass; and the group, comprising figures of the captive and his friends, who had come on a visit of condolence, was in every way perfect. But the back-ground of the picture consisted only of the bare and unbroken prison wall, and the artist felt that something was awanting. To supply this, he painted a window in the wall—and, small and grated though it was, it showed that a universe extended beyond that prison wall—and thus completed the picture. In every painting that pleases there is something that gives rise to the idea of infinitude.

Repton caused an avenue to disappear over the brow of a rising ground, that its termination might be hidden, and that it might give rise to the idea of infinitude.

And why is it that an abrupt termination to a wood or a lake is displeasing? Why is it that we are less pleased with a wood, a sheet of water, or a flower garden, when its shape is seen entire, than when part is hidden? Certainly it is because the imagination delights in being exercised, and would fain soar even towards the infinite. If the infinite gives pain, then nothing in a landscape should be allowed to awaken the idea that other landscapes lie beyond. Let this be granted, and the *Vision of Mirza* must be written over again. It constituted one of the beauties of the abodes of bliss, seen in that vision, that flowery islands extended one beyond the other, in an azure sea, as far as the eye could reach; and there was no apparent boundary to the ocean, or limits to the number of those beauteous islands that diversified its surface. If knowledge is necessary to the appreciation of the beautiful, then Mirza's island-studded sea should have been a circular lake, with table-land of uniform height forming its boundary at the horizon.

Ruskin's theory of beauty, though it has been objected to by certain reviewers, seems to be truthful when compared with that indicated in the above extract. He considers that the principles of beauty and harmony, such as order, unity, variety, and infinitude, are typical of the character and works of the Deity; and, therefore, that they are satisfactory to the human mind. The typical theory would have to be given up, were the principle of continuity to be regarded as displeasing, and as fitted to give pain.

The practice of some planters has given countenance to the theory of knowledge being necessary to the appreciation of the beautiful. The circular clump remained long in fashion, and the

circle was only varied by the oval, while both had for their background a tame serpentine belt of trees, the laying down of the formal sweeping lines of which was a work of much trouble, while the result was that monotonous distinctness which harmonises so ill with the natural picturesque character of trees. That the injurious effect of such planting might be as complete as possible, the clumps were placed on all the higher grounds, as if *clump-capped knolls* had been expected to partake of the poetical beauties of "cloud-capped hills." Even to this day there may be found advocates of the clump, and of that system of alternating convex and concave sweeps, by which a plantation may be adapted to the shape of the hill on the summit of which it stands; and may have its fence line carried round the brow of the hill, as near as may be horizontally, however much varied by hollows and projections the hill itself may happen to be. This mode of planting may render more apparent the shape of the ground on which the plantation stands; and this would certainly be desirable, if the intelligence theory were correct. But supposing this to be the case, what would become of all that intricacy and variety which painters have prized so much, and which have ranked amongst the chief attractions of the landscape garden? When mannerism is followed in any of the fine arts, it is of importance that inquiry should be made regarding the principles of design, and the causes which lead to the appreciation of the beautiful. The word *taste* is used by everybody, but that word too often signifies those likings to particular forms or fashions which have no foundation in truthfulness. And however little it may have been acknowleged by writers on the fine arts, the principles of beauty and harmony bear intimate relation to those Scriptural and evangelical truths, without a knowledge of which the position and prospects of the human race are matters of dark uncertainty. It is because this has been forgotten, that so much falsehood in taste has been manifested. This falsehood was greatly prevalent in the dark ages, especially in regard to architecture and sculpture. Recent revivals of the painted oriels of medieval architecture indicate a relapse into the weak and infantile stage of design. The illustrated magazines that have to date their existence from the era of the Great Industrial Exhibition of 1851, may serve, amongst other things, to form a record of falsehood in taste. As one illustrative example, what could be more incongruous than a circular table, having the body of Hercules for its support, and the table itself being nothing else than the shield of the strong man borne in a horizontal position? When once taste becomes truthful, figures of men and beasts, or any parts of them, will no longer disfigure mere articles of furniture. Everything will then be in harmony with its position and use.

Continuity, whether produced by straight or sweeping lines, forms an essential element in the general adornment of a country-

side,—an object which requires unity in the whole landscape, and, consequently, the absence of all marked boundaries between policies and the grounds surrounding them, and between the estate of one landed proprietor and that of another. The sense of property is not necessary to the enjoyment of the beautiful—that is to say, such a sense of property as results from the possession of charters and parchments. There is indeed a sense of property that heightens the enjoyment of the beautiful, but it consists in an assurance of relationship on the part of the spectator to the Owner of all the earth. Cowper embodied this sentiment in one of his poems, and Chalmers repeated it on first ascending Ben Lomond and casting his eye round on the scenery beheld from that lofty mountain. In the writings of at least one landscape-gardener a similar feeling is recorded. In Loudon's "Treatise on Country Residences," published in 1806, when its author was but a young man, the following passage appears :—

> The last purpose that I shall take notice of is, where a person has in view *to feel and enjoy all the appearances of nature.* He requires few directions ; his habitation, whatever it be of itself, whether an obscure cottage or village garret, will be a situation, if possible, where "nature, unconfined, displays all her graces." His property is all nature ; and, knowing no bounds to his estate, he may therefore change his residence at pleasure. Content to receive from man only what are called the necessaries of life, he is sure of enjoying the most sublime mental luxuries which heaven and earth afford ;—and whether he opens his eyes and beholds the rising sun dispersing the clouds which empurple the distant horizon, or, shutting them, contemplates that variegated circle of colours which is formed by the compression of the eyelids,—whether he remarks the 'green blade which twinkles in the sun,' or 'the huge oak which in the forest grows,' his soul is alike exalted in the discovery of divinity.

And after a life of harassing cares and incessant labour, the writer of this paragraph bore testimony to the fact, that there can be no peace of mind without the knowledge of Christianity.

If there is sentimentalism in such feelings, it is of a truthful kind ; and those are to be envied who possess it. Such persons can ill appreciate the motives of those designers and planters who lay it down as a rule that all plantations which may be seen "from the windows of a gentleman's house, or from any part of his pleasure-grounds," should be tastefully laid out—come what will of such as are not visible from these favoured points of view. The sentence within inverted commas occurs in a modern work on arboriculture, and is here quoted for the purpose of having its principle disowned. A garden may confine its beauties within its wall or its hedge ; and, to preserve its character as a place of seclusion, it is requisite that it should do so ; but the beauties of plantations should belong primarily to the district of country in which they exist. Hence the error of those designers who surrounded the park by an exclusive *belt* of trees was an error of principle, and not merely to be condemned on account of changes in fashion.

It is possible for fashions to change, and yet for principles to remain unaffected.

This brings us back to the point of dispute between the comparative merits of the straight line and the curve. Both have been fashionable, and both have been unfashionable. It is not necessary that the one should be condemned for the sake of upholding the other. Were it true that the infinite gives pain, and that the straight line is peculiarly suggestive of the infinite, then farewell to the avenues of the French style, the canals of the Dutch style, the terraces of Italy, and all the distinguishing features of modern street architecture; Princes Street, once the pride of the Scottish metropolis, becomes a deformity; and the promenade of the Champs Elysée in Paris must be broken up, and have its fine perspective destroyed by the introduction of serpentine lines. But the infinite does not give pain, and the straight line is not necessarily or exclusively suggestive of the infinite. On the contrary, the straight lines and consequent right angles of geometric landscape-gardening have oftentimes an effect exactly contrary to that of continuity, while the alternating curves of the "line of beauty" may well invite the idea of infinitude. By a circle, or any segment thereof, "there is something cut out from space—something we can comprehend and KNOW;" but this cannot be said of the serpentine line, or line of beauty; and yet every one will allow that this line is more beautiful than any correctly drawn segment of a circle. The matter resolves itself into this—that beauty is not confined exclusively either to the straight line or the curve; and to neither is it necessary to attach the idea of a painful sublimity. The sublime grandeur of a wild rocky or mountainous country has nothing to do with straight lines; and the beauties of a terrace or promenade exist independently of the curve. There is, indeed, a peculiar beauty in a crescent or circus of street houses; but part of this beauty is the result of contrast, and a city would have a monotonous effect were all its streets to be segmental or circular,

The cone has been reckoned to possess a greater degree of beauty than any other body, because it unites the three elementary forms of the right line, the triangle, and the circle. This supposes that all the three forms are beautiful, and the landscape-gardener will be safe to act on this supposition. In some styles of gardening these elementary forms may be combined, and in others it is necessary to keep them separate. In picturesque planting the serpentine line is to be avoided equally with the straight line or the triangle. In forming fences around proposed plantations, it is necessary sometimes, to save expense, to choose lines that are straight or of easy curves; but intricacy may be produced even when the trees are young, by planting groups without the fence, and by leaving spaces unplanted within it. These blank spaces within the fence may afford grass for cutting, and will thus be not

altogether useless. This mode of planting may be condemned by him who looks at a plantation only with the eye of a practical forester, and who regards blank spaces as deformities, and thinks that a plantation is only perfect when all its space is occupied with free-growing trees standing at regular distances. The forester and the picturesque planter act from diverse motives; the one looks to the pecuniary value of the trees, and the other to their individual or collective beauty. Let the forester have it all his own way, and picturesque beauty will be sacrificed; but the designer may provide at once for beautiful effect, and for pecuniary value in a large measure—though, of course, something of this last must be sacrificed.

Whatever lines and forms may be adopted, it will be well for the landscape-gardener to adhere to the grand leading principle of continuity, or unboundedness in scenery. Let metaphysical philosophers say what they will about the necessity of knowledge to the enjoyment of the beautiful, that landscape will always have the most pleasing effect which affords food to the imagination rather than to the reason. The soul is immortal and aspiring, and delights in picturing an extension of the scenery that lies within the range of the bodily vision. This occupation is entirely connected with the imagination, and is unaffected by any knowledge we may possess regarding the real character and appearance of what is hidden in a landscape. It is enough if at the farthest-off point of any object there be no appearance of abruptness, but rather something to excite the idea of continuation, and lead to an aspiring after the infinite. When a landscape is ornamented in this way, we may say with the poet, "Immortals have been here; could aught but souls immortal this have done!"

Experiments on the Vegetation of Barley in Artificial Soil. By Dr W. Henneberg, Chemist to the Royal Agricultural Society of Hanover.—I was charged by the President of the Agricultural Society again to make use of the experimental boxes placed in the Botanic Garden at Brunswick, which had remained unemployed since the departure of Professor Polstorff, who handed over to me, at my request, the result of the experiments on vegetation previously instituted by himself. On the following report of these in the summer of 1851, I immediately published some remarks, in order to guard, from the commencement, my colleague Mr Phin, the botanic gardener there, and myself, from the reproach of over self-estimation of our performances. We would wish our work to be regarded as only an "attempt at experiments." A publication of this attempt is justified, at any rate, in this point of view, that a preliminary indication of the sources of failure which occur in a particular kind of experimental researches, conduces to the rendering the result of later labours in this field more certain. Mr Polstorff's researches on the constituent parts of the soil neces-

sary to the successful growth of barley plants, has led to the conclusion *—

1. "A soil which is endowed with the most appropriate and most superior physical properties for the cultivation of plants, yields no crops when limited to these alone."

2. "A soil which is free from all organic substances yields the highest return, provided it possesses the appropriate physical qualities, and contains, in a suitable form, the necessary mineral constituents of plants."

In order to arrive farther at the knowledge of the regularity which presides in the life of plants, we have at present, in regard to the nutritive constituents of the soil, to direct our particular attention to—

1. The quality.
2. The quantity.
3. The form of the mineral manure-media.

We therefore proposed to ourselves the following propositions for our experiments on barley culture:—

1. Polstorff's experiments had given the result, that the addition of a so-named humus matter—as, for example, decaying vegetable matter—to the kind of soil consisting of mineral bodies, had been without any favourable influence on the vegetation of the barley. Nay, more, in the year 1847,† the box No. 7, which contained no humus, gave 1863 grs. more in grain and straw than the box No. 8, in which the same mineral constituents were mixed with ½ lb. of humus. A repetition of this experiment seemed of importance, as we must consider the humus, even according to the most decided opponents of the humus theory, as a source of the nutrition of plants.

2. In order to procure the most suitable chemical form of the mineral constituents of the soil which should bear barley, we selected three different compositions. The mineral matters were at one time formed into the simple mixture which is regarded as that of the barley ashes, with the distinction that, instead of the phosphate of lime or burnt bones, finely powdered animal charcoal was employed. In both these cases the mixture was so prepared that the insoluble matters of it in the water, especially the bone earth, were conveyed in soluble combinations; at one time by treatment with sulphuric acid, and at another by the calcination of the mixture at a red heat.

3. The favourable influence of a manure with salts of ammonia on the cereals, and species of grass generally, may no longer, indeed, be doubted, after the experiments of last year; and yet, in the opinion of some vegetable physiologists, it was a question

* Communications of the Agricultural Society in the Duchy of Brunswick, 17, 75.
† Communications of the Agricultural Society in the Duchy of Brunswick, 15, 43. Also Ann. d. Chem. et Pharm., 26, 180.

whether or not to the mineral manures which occur in the ammoniacal manures (guano and ganche,* for example) is to be ascribed the principal part of their favourable effect, or whether the supply of the ammonia may not especially stimulate the vegetation, and thereby cause to be more easily assimilated many materials important to the life of plants, which are contained in the soil in a form little adapted to assimilation. We have here especially had in view the solubility of the phosphate of lime in watery solutions of ammoniacal salts. In order to elucidate this relation, we conducted some experiments with a pure salt of ammonia, (sal-ammoniac,) and added it to the three different mineral manures.

4. The quantity of the manure was hitherto not regarded, as comparative experiments had been made with different quantities of it, but each experiment-box contained such a mixture of ash constituents as corresponded to six of the most abundant crops which Mr Polstorff had before observed in the boxes. The weight of the mixtures of the different manures was so calculated that they, the sulphuric acid, water and charcoal, being excluded, should contain like quantities of the elementary constituents.

The experimental boxes are lined with lead, provided at the bottom with a hole, (for the outflow of water,) and in size 2 feet long, 1½ foot broad, and 1⅛ foot deep. The artificial soil which serves to fill them consists of 1 part by measure of a mixture of 1 part by weight of white bole, 2 parts by weight of chalk, 1⅛ parts by weight of wood charcoal, and 3 parts by measure of white sand. In addition, each box contains the ash constituents of 1¼ lb. of dry tree soil,† partly as ashes, partly as unburnt tree soil. For the purpose of providing the plants with soluble gravel earth and kali, a preparation of felspar was employed, which was obtained by submitting to a red heat 3 parts of prepared felspar, and 5 parts of burnt lime. The mass heated to redness was allowed to fall to pieces in the air, the whole reduced to powder, and 1½ lb. of this mass allotted to the corresponding boxes. For exhibiting the specific manures, there was mixed

6 parts of bone-ashes, or a corresponding mixture of bone-charcoal.
1 part of calcined soda.
1 do. burnt magnesia.
1 do. burnt gypsum.
1 do. common salt.

The manure A consists of a mere mixture of these bodies. It contains phosphate of lime in the form of bone-charcoal, and 1926 grs. of it correspond to the six crops of 2000 grs. of grain, and 2700 grs. of straw. The reaction of the manure is alkaline.

For composing the manure B, (used by Polstorff in the earlier experiments,) the bone-charcoal was reduced to ashes, and then exposed, along with the other substances, in a crucible to a red

* The liquid manures of stables and byres are thus named.

† By "tree soil" we believe decayed vegetable matter, or soil rich in humus, is meant.

heat. 1440 grs. of this preparation present the equivalent for 1926 grs. of the manure A. B also has an alkaline reaction.

For the composition of the manure C, the bone-charcoal was put into water, and mixed with fifty per cent of English sulphuric acid, then soda and magnesia, and last of all gypsum and common salt were stirred into the mixture. 3541 grs. of this mass dried, in a water bath, are equivalent to 1926 grs. and to 1440 grs. respectively of the mixtures A and B. The preparation being completed, shows a neutral reaction. 107 grs. of sal-ammoniac, which were employed in each box as ammoniacal manure, are equal, perhaps, to a guano manure of 350 lb. per Prussian acre.

The distribution of the manures into the different boxes was as follows:—

Box No. 1,	.	Tree-earth ashes.
„ 2,	.	Burnt felspar, tree-earth ashes, and manure B.

The rest of the boxes contained together burnt felspar, unburnt tree-earth; and in regard to the other manures, they differed in the following manner:—

No. 3,	manure	B.
„ 4,	„	A.
„ 5,	„	C.
„ 6,	„	B and sal-ammoniac.
„ 7,	„	A.
„ 8,	„	C.

The box No. 1, without specific barley-manures, ought to give the measure of the capability of production *(productiveness)* of the artificial soil, and of the tree-earth ashes mixed with it. The 2d and 3d boxes—which differed from each only in this, that the one contained tree-earth unreduced to ashes, and in the other it was converted into ashes—refer to the question respecting the influence of the organic manures. The boxes 3, 4, and 5, should, together, explain the most suitable form of the mineral manure. The boxes 6, 7, and 8, contain the different mineral manures in the same succession as in from 3 to 5, only there occurs in them at the same time the sal-ammoniac manure, for the purpose of solving the first of the three queries proposed.

The boxes were filled, on the 10th May 1851, with tree-earth and felspar, to the depth of from 4 to 5 inches, and the specific manures were introduced by the hand to a somewhat smaller depth. The intermingling of the manure materials at so slight a depth under the surface was done in the anticipation that the weather would continue as rainy as it had been previously. The fall of rain-water would then produce in the best way the uniform mixing of the soluble constituents with the rest of the soil, whilst there would have been reason to fear, had the manures been mixed to the bottom along with the earth, that an important part would

have flowed out of the box from the rain trickling through. The anticipation of the rain was not fulfilled, and it was found to be necessary to have recourse to abundant sprinkling with distilled water.

On the 17th May, 46 grains of barley were all deposited in each experimental box, two at a time in each plant-hole, and in five rows, removed from each other respectively four inches. The seed was the ordinary two-rowed small barley; a grain of which weighed 0.75 grs., so that the seed-corn amounted to about 34.4 grs. per box. According to the arrangement, the sal-ammoniac manure was given to the three last boxes.

The barley sprang up on the 27th May. On the 7th June, when the plants were two-leaved, and about four inches high to the extreme point of the leaf, they had dwindled down to about twenty-three plants per box. The box No. 1 had a decided superiority in a rapid development of the plants; on the other hand, the plants in the boxes 6, 7, and 8, were distinguished by a far darker colour.

The constitution of the earth—where the tree-earth was awanting, most particularly in the box No. 2—was not such as is desired for a barley soil, being somewhat too stiff. The due state of moisture was, when the rain was deficient, supplied by sprinkling with distilled water.

In the progress of the vegetation, the plants in box No. 1 ran through the stages rapidly and uniformly; the plants in the other boxes proceeded slowly and unequally. The weather during the summer and autumn of the year was altogether adapted to make exact results impossible, even though all the other conditions of a favourable result had been fulfilled in the conducting of the experiments. The harvest could not be begun before the 9th of September; it was prolonged to the 11th October; and we were even then obliged to reap the ears partly unripe, as we were afraid of otherwise entirely losing the produce. Mice had got there, and bit off the ripe ears, and stript off the grain. The irremediable loss which thus happened, might be calculated to a certain degree, as the proportion of straw to grain was ascertained in the unripe ears; and by means of the proportional number thus found, a conclusion was formed of the weight of the grain produced from the known weight of the straw. In the following table the corrected productive results are stated; and where only a proportionally small part of the corn crop served for determining the entire produce, the sign (??), and where the mice had actually caused damage, but in a slighter degree, the sign (?) are added to the numbers. The weights were taken in January 1852.

No. of the Box.	Time of Harvest.	Number		Weight when dried in the air		Total Crop.	Corn Weighed.	Stubble 1½ inch long, and Roots.
		Of the Plants.	Of the Haulms.	Of the Corn.	Of the Straw.			
				gr.	gr.	gr.	gr.	gr.
1.	Sept. 9	23	58	672 1.00	765 : 1.14	1437	0.73	110
2.	Sept. 25 to Oct. 11	21	35	166 1.00	273 : 1.64	439 (?)	0.61	45
3.	Sept. 9 to Oct. 11	22	?	565 1.00	531 : 1.94	1069 (?)	0.73	77
4.	Oct. 4 to 11	23	44	297 1.00	405 : 1.36	702 (? ?)	0.56	47
5.	Sept. 9 to Oct. 4	23	77	519 1.00	614 : 1.18	1133	0.67	74
6.	Oct. 11	23	79	553 1.00	753 : 1.36	1306 (? ?)	0.65	90
7.	Oct. 4 to 11	23	80	699 1.00	748 : 1.07	1447 (? ?)	0.53	90
8.	Sept. 9 to 25	23	77	898 1.00	848 : 0.94	1746	0.68	110

If the produce of the first box, which had contained no specific barley manure, but merely tree-earth ashes as the manure material, exceeded in a striking degree that of most of the others, we can only ascribe this to the circumstance, that in No. 2 to 8 the quantity of the mineral manures—viz., of the preparation of the felspar, was too large in proportion to the artificial soil mixed with it. This discovery was made some time ago by Professor Magnus, in Berlin, whose experiments on vegetation in sugar charcoal then first took place, when he had removed the excess of the mineral-manure material from it by extraction with water. We can understand the cause of the failure, especially in No. 2, where the roots of the plants, instead of penetrating deeply, had developed themselves along the surface, and this evidently because here the excess of the manure material had floated above. The soil, moreover, of this box immediately under the surface had a compactness which could not answer for barley plants. The productiveness of the soil in box No. 1, which contained no specific barley manure, is easily explained. The ash constituents for a crop of 1437 grs. are richly afforded by the wood-charcoal and the burnt tree-earth of the mixture. The foreseen rapid decrease of the produce of this box during the succeeding years will supply a new proof of the indispensableness of the ash constituents. If we leave the box No. 1 out of consideration, and compare the crop results of the other boxes with each other, we shall then obtain the following answers to the queries proposed:—

1. From comparing the boxes Nos. 2 and 3, a very favourable influence of the organic manure appears here very evident. The box No. 3, which was manured with tree-earth, unreduced to ashes,

gave nearly 2½ fold more in the total produce, and 3½ fold more in corn than No. 2. How far this improvement of the soil is to be ascribed to the mechanical action of tree-earth, and how far to its chemical effect, we cannot decide. Polstorff's experiments, in 1847, have, as mentioned, not verified an increase of produce through organic manure.

2. In regard to the most suitable chemical form of the mineral manure, we see from the table of the crops, that the boxes Nos. 5 and 8, which were both manured with the sulphuric acid preparation, in the two corresponding series of experiments, 3–5 and 6–8 have yielded the highest produce. It would thence follow, that the form of the sulphuric acid salts is the most preferable, at least for one year's effect. Whether calcined ashes, (Polstorff's preparation,) or the mere ash-mixture is to be preferred, cannot be determined with certainty from the crop results. The two boxes 3 and 4 speak decidedly for Polstorff's preparation. It has, compared with the ash-mixture, yielded a higher total produce, by about a half, and about a double higher corn produce. In the boxes 6 and 7 the case is reversed; though the deviations in favour of the mere mixture are not so striking as those in 3 and 4, they will be found in favour of the other manure. A particular influence of the ammoniacal manure probably manifests itself in these differences of result.

3. The latter has always increased the result, and in the proportion, indeed, of 2931 to 4499, ("*sic* in original,") when the returns of the crops in both series of boxes 3–5 and 6–8 are compared together. We observed this increase of produce in every form of the mineral manure, though not everywhere in an equally high degree; and in the most striking manner where the mere mixture of the unprepared ash-constituents is employed. The effect of 107 grs. of sal-ammoniac on the crop, in the boxes manured with salts of sulphuric acid, will be expressed by the number 0.53; in that manured with calcined ashes, by the number 0.22 (the returns of produce are in the proportion, viz. of 1 to 1.53, and 1 to 1.22); the value, calculated in the same way, amounts, in the boxes manured with the ash-mixture, to 1.06. Had the favourable influence of the sal-ammoniac manure its foundation only in this, that it provided the plants with a nutritive matter necessary to their constitution, it could not then be comprehended why the same quantity should at one time produce a smaller, and at another a greater effect. But a difference of effect is evidently displayed in the present experiments. With respect to the cause of this difference, we shall show, by a consideration of the fact, that the increase of the produce is the most marked where an exclusive preparation of the ash-constituents has not been employed—where the phosphoric acid, for example, in the form of insoluble bone-earth, stood at the disposal of the plants. The sal-ammoniac was in this case, as it were, the mediator of a more

easy assimilation of the phosphoric acid. We have, therefore, here also to distinguish a direct and an indirect effect of the manure-medium.

The result of the experimental researches which aim at a further cultivation of the doctrine of manures, will essentially depend upon the attention that is paid to this distinction. Hitherto experience, viz.—of English land cultivators—teaches (as the author has pointed out in another place *) that for *the highest* cultivation of the soil, the *mass* of certain manure materials is of high importance. The highest possible intensity of economical management of a landed property appears to be dependent upon a surplus of salts of phosphoric acid, along with mineral materials, and to a surplus of azotised matter along with the nutritive media, which is richly supplied by the atmosphere to the plants growing wild. Both phosphoric acid and azote are supplied to the land from without, as articles of commerce. We propose to ourselves the further prosecution of the special plan, which serves as the base of this inquiry; and entreat that, until further, the value of hypotheses only may be attached to our conclusions.

Parks and Pleasure-Grounds.†—Landscape-gardening, properly so called, originated in England, and hitherto it has owed its improvement and progress chiefly to the labours of English artists and authors. It is remarkable, that, while Scotland has been the nursery of able horticulturists, some of whom have become skilful garden architects, or *planners*, as they used to be called in our northern parlance—it has, previous to the existing generation, produced no landscape-gardener of any celebrity, with the exception of the late Mr Loudon, and he practised almost exclusively in the south. The art, indeed, was not entirely neglected among us. Old pleasure-grounds, originally formed in the French or Dutch style, were improved, and new places were laid out, either by native talent, which contented itself with single efforts, or by the labours of English practitioners. Landscape-gardening, however, was a favourite subject of study with literary country gentlemen. Sir Walter Scott, we believe, designed his own grounds at Abbotsford, and wrote some pleasing essays on gardening and planting. Other amateurs have begun with the improvement of their own residences, and have been induced to give the public the benefit of their experience. These gentlemen, it is understood, have been very successful in the talking department of the profession—a much more important element, in the practice of some of the arts, than the inexperienced are apt to imagine. So far as we are aware, the author of this volume is

* Dr M. Hamm's Agrom. Gazette, 1851, No. 26.

† Parks and Pleasure-Grounds: or, Practical Notes on Country Residences, Villas, Public Parks and Gardens. By Charles H. J. Smith, Landscape-Gardener and Garden Architect. Reeve and Co., London.

the first who, after a professional education specially adapted to his views in life, has devoted himself, as a resident in Scotland, to the practice of landscape-gardening. It is evident from his book that he has not confined his studies or his practice to this country.

In his preface, Mr Smith informs us that he had been often requested by his employers to recommend a book on landscape-gardening, and that he had much difficulty in finding one sufficiently practical and intelligible. We do not wonder at this, for though the literature of the art is by no means scanty, there is hardly a book, with the exception, perhaps, of Gilpin's "Hints," and it is only limited in its range, which at all approaches that character. The authors of note have generally done the very reverse of writing "small books on great subjects." Their lucubrations, for the most part, have been bulky, expensive, and not unfrequently deformed by an acrimony of controversial discussion scarcely surpassed by the rabid disputes of philologists. Mr Smith has aimed at avoiding these faults, while he has sought to supply their deficiencies; and we think he has perfectly succeeded. In a moderate-sized readable volume, he has exhibited the substance of what has hitherto been known of the principles and practice of the art, and has added some important contributions of his own. His information is presented in a well-arranged and compact form, and is expressed in a style which, if it has no pretensions to eloquence, is simple, direct, and perspicuous. Any reader of ordinary intelligence and acquirements will be able to understand the whole volume, with the exception, perhaps, of the valuable scientific matter in the last two chapters, which is intended more particularly for practical botanists. We are not acquainted with any book so likely to render efficient aid to a proprietor engaged in improving his grounds.

The work is divided into fourteen chapters, and its substance will be most readily estimated from the following enumeration of their subjects: The House and Offices—The Approach—Pleasure-grounds, and Flower-gardens—The Park—Ornamental Characters of Trees, detached and in combination—Planting—Fences of the Park and Pleasure-grounds—Water—The Kitchen, Fruit, and Forcing Gardens—Public Parks and Gardens—The Villa—General Observations on the laying-out and improvement of grounds—The Arboretum—The Pinetum. Our limits will not permit us to enter into a detailed account of each of these chapters, which, of course, are not all of equal interest or originalty. Mr Smith gives them all as the results of his own experience, and the reader will find in them much precise information, and definite and apparently well-considered judgments, on matters of difficulty.

Passing over, then, the chapters on the House and the Approach, not as being unimportant, but as likely to occupy too much of our space, and simply alluding to the very interesting series of remarks on the Pleasure-ground and Flower-garden, we are called,

by the leading subject mentioned on the title-page, to direct our attention to Chapter iv.—the Park—which is one of the ablest in the volume. After some ingenious observations on the unity of the Park, the natural and acquired characters of the ground, and the surfaces to be planted, the author proceeds to the arrangement of woods in the Park. Part of this article we may quote as a specimen of the work:—

In carrying out the arrangements of the woods, the designer should begin with forming certain leading systems of masses to be filled up and completed by secondary and minor combinations, together with the necessary clumps or groups of scattered trees. For the principal masses a few leading positions should be selected. The House and Pleasure-grounds should be included in one. A hill, or rising ground, or rounded eminence, may form the centre of a second or third; while the boundary of the park towards the home-farm, or other portion of the boundary where disagreeable objects are to be concealed, may afford room for a fourth or fifth. The secondary combinations, though inferior in extent to the primary ones, will yet in many parks be of sufficient dimensions to veil the stables and farm-offices, and to shelter the kitchen-gardens when these are placed in detached positions;—they may also be employed with good effect in other places, such as around the entrance-gates and lodges, the gamekeepers' and park-keepers' cottages, and along the boundary of the park. The secondary masses are also serviceable in connecting the principal ones, and so making up what we have called the systems or main combinations. The minor combinations are frequently required for the same or similar purposes, especially when they are formed of groups of trees. The size, number, and variety of these diversified aggregations of trees necessary for the decoration of the park will of course depend very much on the extent of the ground and the natural character of the surface. When it is intended to give the whole what is called a park-like appearance, spaces of grass land of considerable length and breadth should be left open between the principal masses of plantation, and also between a number of the secondary ones. On the other hand, when it is desired to impart to the place the character of woodland scenery, the main combinations should be enlarged and drawn more closely together, and the grass lands should be reduced to the form of glades and openings in the woods. In localities with a level surface, where little is seen beyond the park, and where the creation of as large an amount of scenery as is possible within it is an essential element in its formation, the combinations of masses of plantation will necessarily be fewer, and placed farther apart than where the surface operated on is of an undulating hilly character. Where a large body of wood is required, it is injudicious to form the leading and secondary masses into dense and almost impervious thickets, as is too frequently done; it is better to arrange them into a gradation of masses interspersed with lawns, glades, and other openings, in addition to the rides by which they may be traversed, and the ordinary roads necessary for their management. Where the main masses are small, a similar effect may be produced by lesser openings and indentations. In both cases groups of trees and single trees should be scattered through the glades and along the margins of the larger bodies of wood. This is exemplified in those places in which masses of wood are seen forming pleasure-grounds round the mansion-house. We do not mean that these masses of wood in the park should be dissected into as many and as small divisions as are often necessary in the dressed grounds; but there are many places in which the woods are greatly enlivened by such open spaces, and by the addition of a few clumps and groups of single trees relieving, yet attached to, the general masses. In hilly and mountainous countries large masses of wood are sometimes planted; but it is seldom desirable to intersect these with wide openings or lengthened glades. A better effect is produced by bays and indentations, as already recommended. When the woods have been formed, as above explained, into a variety of leading and secondary combinations, the position of the individual plantations should be such as obviously to appear portions of their own systems. They should vary in size as well as in form, and should be separated by open spaces of varying breadth. The projections of one may advance towards the recesses of another. In many cases they may be blended into one whole by means of groups of trees scattered round and amongst them: these will produce a light and varied effect, and tend to counteract any formality in the general outlines.—P. 71-74.

The author pursues the subject into its more minute details, and takes occasion to denounce and expose what has been called *The Dotting System*, a tasteless method of planting single trees at regular intervals over surfaces, borrowed apparently from the flower garden and shrubbery. As he does not notice the *Gardenesque Style* of planting proposed by Mr Loudon, we suppose he includes it under this same Dotting nuisance, to which, it must be admitted, it too closely approximates.

Mr Smith justly attaches great importance to trees, as means of decoration, both in the park and pleasure-ground; and perhaps his chapter on the "Ornamental Characters of Trees, detached and in combination," contains more new and generally interesting matter than any other in the volume. The subject has been strangely neglected by preceding writers, and when we read what is said on it in the present work, we cannot help feeling surprised that it should have been overlooked so long. The following extracts refer to the forms and colours of trees :—

The forms assumed by the individuals of any species of tree, such as the oak or Scotch fir, vary much with the soil, situation, and age of the particular tree; yet amid all their diversities they preserve a character at once discernible by the practised eye. The oaks in the rich and open park, in the crowded forest, and in the mountain ravine differ greatly from each other; but they are plainly oaks, and have each a beauty of their own. How dissimilar also the plume-like ash in its youth, rushing up in some sheltered valley, to the round-headed ash of middle age in an open situation, and still more to the gnarled, large-timbered, wavy-boughed, and pendulous-branched ash, bending under the weight of years. In the same species, too, there are often constitutional differences, amounting almost to what botanists call varieties. These circumstances necessarily preclude minute verbal description. Still, there are certain general forms affected by trees in their natural growth, and all that is required for the purpose of the planter is to keep these steadily in view. Though every species and variety of tree has its own peculiar expression, if not distinct character, we do not deem it necessary to advert to each separately, believing it to be sufficient for the illustration of our subject to class them under four leading divisions, and then to refer to a few of the kinds principally employed in ornamental scenery. As we go on, we may point out their most suitable and effective positions in the park and pleasure-grounds.

The *first* division consists of trees with broad, round heads; the *second*, of those with a spiry, conical, or pyramidal configuration; the *third*, of those with upright, or oblongated forms; and the *fourth*, of those with weeping, or pendulous branches. The reader is reminded that these forms are given merely as approximations : he is not to attach to them the precision of geometrical figures.—P. 86–7.

The tints of colour exhibited in trees are, perhaps, as numerous as their forms. To advert at present only to the foliage—the normal colour of the leaves is green; but how diversified are its shades ! In the deciduous class of trees these shades range from the silvery grey of the Huntingdon willow and white poplar through the light green of the larch and lime, the full green of the sycamore and oak, to the dull dilute green of the alder. And in the evergreen species the shades pass from the white cedar of Mount Atlas, and glaucous Indian cedars, to the dark green of the holly and yew, and the almost black-green of the aged Scotch fir. Here, then, are abundance of colours for the landscape artist—colours requiring from him most attentive consideration, and on the skilful and harmonious employment of which the success of his work will in a measure depend. . . . . If, in planting the park and pleasure-grounds, all varieties of colour are to be taken into account, the tints of the ripening leaf ought not to be forgotten, as we fear they too often are. It should be remembered that the ripening and fall of the leaf sometimes occupy five or six weeks of a season, which, if chastened with sadness, is to some minds a period

of intense enjoyment. We may add that oaks, particularly in copse woods, and in the early stages of growth elsewhere, often retain their leaves during most of the winter. These supplementary tints of the departing year afford means of ornament not altogether unworthy of attention.

The flowers of certain trees also yield effective, though transient, elements of colour. Some of our readers may have come unexpectedly on a fine laburnum, or thorn in blossom, partially concealed in a secluded wood, or overhanging the bend of a remote stream, and may have received from it an impression which has not yet passed away. We need scarcely point out the rich effects produced at times by the snowy flowers of the wild cherry and sloe, by the creamy bloom of the hawthorn and bird-cherry, and the more varying pink and white of the wild apple and the horse-chestnut. Then there is the delicate pale yellow of the flowers of the lime and Spanish chestnut, later in the season. Among the underwoods we have the brilliant yellow of the elegant mahonias in spring, and in June the lavish purple of the Pontic rhododendron, one of the hardiest and best of all shrubs for making close and tangled thickets in woods.—P. 98-100.

The subject of public parks, now assuming a national importance, seems to have engaged much of the attention of the author, and, along with public gardens, is treated in chapter x.; a chapter in respect to which we are persuaded most readers will wish that it had been longer, and fuller in its details. Nothing material, however, so far as we can see, has been omitted. The purposes of public parks, their utility in a sanitary point of view, and the difficulties with which the promoters of them have to contend, are very clearly stated, and the proper method of laying them out is distinctly indicated. It is matter of congratulation that municipalities are now exerting themselves in forming these most useful places of recreation, and that successive Governments are lending them efficient aid. We wish these benevolent undertakings all success. Mr Smith's remarks on street gardens are sensible and pointed, and, we trust, will receive due attention. He further shows, that the principles of landscape-gardening may be exemplified, more than they have been hitherto, in botanic and horticultural gardens, and in the grounds attached to educational institutions. It is to be hoped that official dignitaries, too ready to be self-satisfied, will take his remarks in good part, and put them to profit.

The chapter on the villa is excellent—full of just thoughts and judicious hints, and likely to prove acceptable to a large circle of readers. At present we can only say, that we should like to see it considerably expanded in a future edition of the work, if the public favour, as we hope it will, shall call for one. The distinction, explained at its conclusion, between the park villa and the pleasure-ground villa, is new to us, and seems to promise a greater variety in the forms of this pleasant kind of residence than has yet prevailed in them.

The chapters on the arboretum and pinetum, which conclude the volume, have a less extensive interest attached to them, and may, therefore, attract only partial attention; but, to some, they will considerably enhance the value of the work. Collections of trees, either general or special, are becoming increasingly numerous; and,

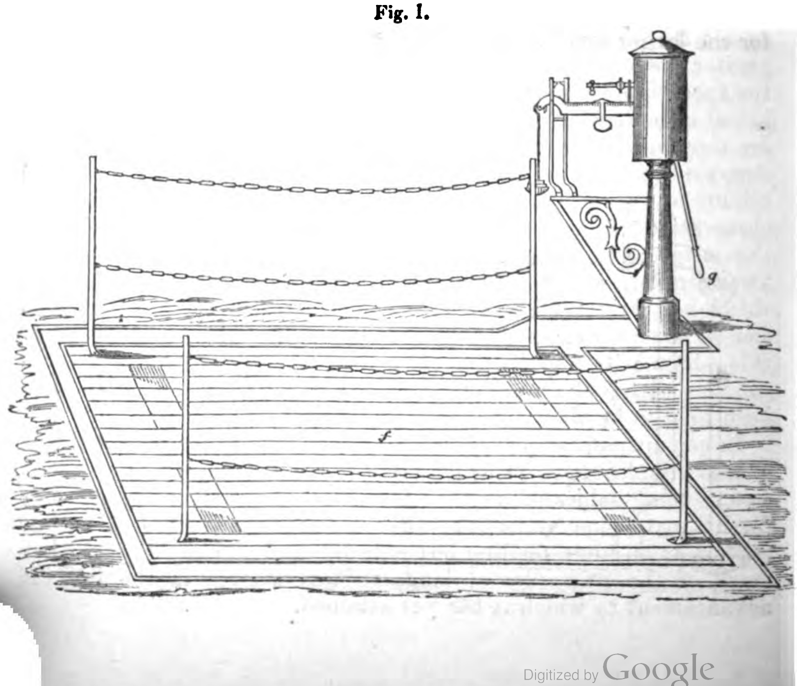
their utility being considered, they should certainly, one or other of them, have a place in every public park or garden. Perhaps the general reader will disapprove of the introduction of so much scientific matter into a work of taste as occurs in these chapters. We own that, at first sight, we had a feeling of its incongruity; but we are constrained to admit that the author has done right in the view which he has taken; for, as he justly remarks, "we might as well discuss the topography of a country without a map, as describe an arboretum, or give directions for its formation, without reference to the scientific principles on which its arrangement is based." Certainly ornament must be based on some substratum; and without his exposition of the scientific treatment of the arboretum, he could not have made his decorative treatment of it at all intelligible. Accordingly, he gives a synopsis of the alliances, orders, and genera of trees, on the principles of the natural system, as exhibited in Dr Lindley's Vegetable Kingdom, but adapted to his own purposes; and combined with this, the estimated number of the hardy and subhardy species, and their average range of height. This table, which is evidently the result of considerable labour, will be extremely useful to those engaged in forming arboretums. After some remarks on the "transference of the system to the ground," he proceeds, in conformity with the general design of the book, to give directions for the "decorative treatment of the arboretum;" a part of the chapter which seems to have the impress of originality, and which will be read with pleasure by all who take an interest in the arts of design as applied to the cultûre of trees. The author has discussed the pinetum in a similar manner, but apparently with even greater enthusiasm. He gives a very complete enumeration of the species of conifers introduced into this country, and known or hoped to be hardy; and to each of the genera or subgenera, which are those of Endlicher, as given in the celebrated *Synopsis Coniferarum*, he appends a paragraph on the characteristic forms and colours of the species and varieties, mostly derived from personal observation. The chapter concludes with a series of remarks on the culture and planting out of the pines, and their ornamental arrangement, which the pine-fancier will doubtless consider as valuable. Whatever may be the author's success in his discussion of the arboretum and pinetum—and it seems to be considerable—he merits approbation for having attempted to bring these subjects within the province of an art to which, as yet, they have been held to be alien.

In conclusion, we regard Mr Smith's work as another instance of that simplification to which all the arts and sciences are in process of being subjected, and from which we confidently augur their further extension and improvement. We recommend it to our readers as an unpretending but well-digested and thoughtful summary of the principles of landscape-gardening, in the highest advancement to which it has yet attained.

Craig's Improved Weighing Machine.—In 1848, Mr Craig of Liverpool received the first premium, from the Highland and Agricultural Society, for his weighing machine for farm purposes. Its excellence consists in indicating the true weight of any object placed upon the platform, whether on the centre or on any of the corners; whereas other machines of similar construction never indicate the true weight of any object weighed, unless it is placed on the centre of the platform. The improvement now effected in the machine by Mr Craig, is the placing of the apparatus within a cast-iron case, which can be set into the ground at any convenient spot, without the aid of masonry, which formerly was necessary, to a considerable extent, to render the machine fit for use. The advantages of this arrangement are, 1. Compactness of form, greatly facilitating the removal of the machine from place to place; 2. An increased union of parts, rendering them easier understood, and freer from disarrangement; and, 3. The weight is greatly diminished, yet the material is so judiciously disposed as to secure increased strength, and to avoid the danger of deflexion, which is so inimical to the accurate indication of all weighing instruments. The only caution required is, to set the box on a *level* and *solid* foundation. The price of this machine is £20; and with posts and chains, for use when cattle are weighed, £2 more.

The following figures will give an accurate idea of the machine. Fig. 1 represents the machine in working order for weighing

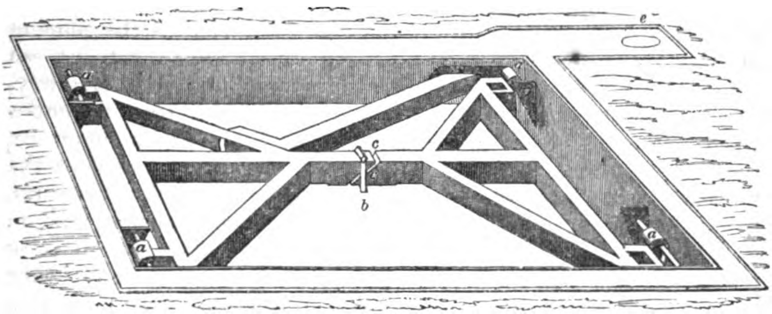
Fig. 1.



cattle with the posts and chains, and where *f* is the platform upon which the cattle or carts stand, and *g* is the handle of the apparatus which adjusts the platform for action. Cattle go upon the platform in the direction along the chains, and carts in a direction at right angles to them.

Fig. 2 represents the box with its levers, where *a a a a* are the

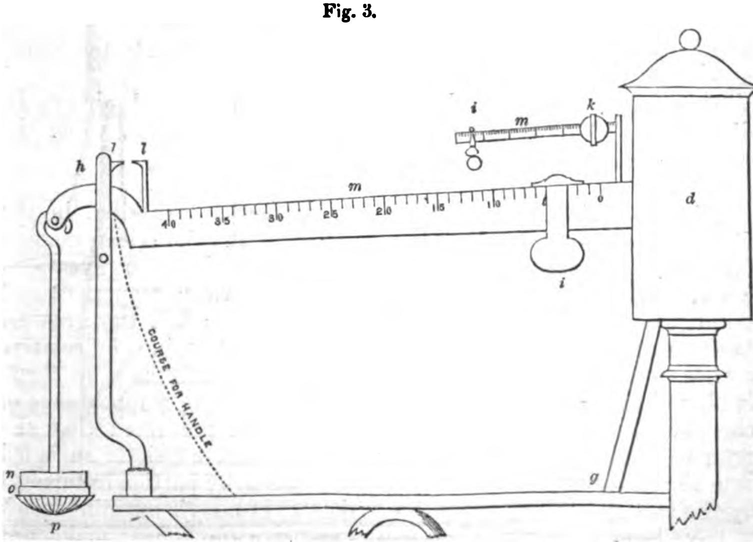
Fig. 2.



links, *b* the buckle, *c* the connecting centres, *e* the long lever, and the circle below *e* the place for inserting the pillar of the steelyard.

Fig. 3 represents the top of the pillar with the steelyard, where *m* and *m* are the large and small arms of the steelyard; *i i* are the sliding poise-weights upon them; *k* the balance ball; *l l* the pointer; *d* is the centre for the connecting-rod; *g* the handle for putting the steelyard in action when hooked to *h*; *n o* are weights used for the larger articles weighed; and *p* is the weight plate.

Fig. 3.



Directions for placing the machine. — Procure a solid foundation for the machine to rest upon, and particularly for the corners and horn of the box, upon either planks or stones. If the machine is intended to weigh carts, the box should be sunk to the level of the road; if only for cattle or sheep, a portable incline on both sides will suffice for them. Place the levers on the links *a a a a*, fig. 2, and adjust the buckle *b* on the connecting centres *c*; then connect the long lever *e* with the steelyard set up in the circular hole below *e*, by hooking the rod inside of the pillar to the link at the end of the long lever. Next place the platform *f*, fig. 1, upon the lever, and the machine is completely placed. When in this state, it will bear any traffic over it without injury to the working parts.

Directions for weighing. — Bring the handle *g*, fig. 3, round by the dotted lines till it is received by the hook *h* at the upper end of the dotted line, when the machine is ready for action. Place the two sliding weights *i i* on their respective steelyards *m* and *m*. Screw the balance ball *k* backwards and forwards till the two pointers *l l* are opposite each other, when the machine becomes perfectly adjusted. The load to be weighed should be placed on the platform *f*, fig. 1. The sliding weights *i i* are sufficient to weigh any load from 1 lb. to 1 ton 28lb., and, with two movable weights like *n*, of 1 ton each, will weigh 3 tons. The weight *o* is used as a counterpoise to the posts and chains when cattle or sheep are weighing. Should the load be more than 2 tons, place the lever-weight *n* on the scale-plate *p*, and bring forward the large sliding weight *i* on the larger steelyard to the notch next to that which will depress it, say at 7; then bring forward the sliding weight *i* on the upper and smaller steelyard, till the pointers *l l* are exactly opposite each other, say 26, when the exact weight will be 2 tons 7 cwt. 26 lb., or 219½ stones, of 14 lb. to the stone, and 8 stones to the cwt.

When not used in weighing, the machine should always be disengaged, as horses and cattle go with less dread when the platform is in a dormant state.

Rival Reaping Machines.—Had every article exhibited in the Crystal Palace received as much notice as the American reaping machines, the excitement created would last for many years to come. The comparative merits of the American reapers caused some interesting discussions and experiments; but the greatest excitement has arisen in the endeavour to determine the relative merits of an old reaper, long known and partially used in Scotland, and of its American compeers. But for the reappearance of the old machine in a state of activity, it is presumed that the relative merits of the American ones would have quietly subsided into the adoption of one or the other of them by parties influenced by the eulogy of their respective makers. Hussey's machine seems to have been adopted by the most extensive implement-makers of

England in preference to M'Cormick's, and not fewer, it is said, than fifteen hundred of them have been distributed over England; and probably it would have held possession of the field for years to come. So easy a harvest was not, however, permitted even the most celebrated implement-makers to reap. The old Scotch reaper, like a giant refreshed by long sleep, came suddenly forth at the beginning of harvest and threw down the gauntlet, and challenged its younger American imitators to a trial of skill of their respective powers; and Mr Slight's historical sketch of it in the Transactions of the Highland Society may have emboldened its owner to adopt so courageous a line of conduct. It is said that Mr Bell was desirous of exhibiting his reaper in the Great Exhibition, but that he was dissuaded from doing it. Had it appeared there, the discussion on its comparative merits with the Americans' would probably have been agitated at once. As the circumstances happened, this harvest was certainly the most proper time for putting the controversy to the test. In the first encounter, at the Highland Society's Show at Perth, Bell's "Lass of Gowrie" completely defeated the Hussey-Crosskill champion, by the unanimous verdict of thousands of professional spectators. It obtained a similar victory on Keillor farm shortly afterwards, in consequence of a specific challenge, which, however, was not accepted. The said champion was also defeated by M'Cormick's reaper, according to the decided report of the Driffield Farmers' Club; and lastly, Hussey-Garnett's reaper was beaten by M'Cormick's on the farm belonging to the Agricultural College of Cirencester. It is further stated, that Bell's reaper came off victor in a trial with a new competitor by Robinson, implement-maker of Belfast, before members of the Irish Improvement Society near Dublin. It was announced in the programme of the proceedings of the British Association at Belfast, that a model of Robinson's reaper, represented as an improvement on Hussey's, would be described in the Mechanical Section, but we understand that it was not produced there, and can give no idea of its construction. The only trial now desiderated is one between Bell's and M'Cormick's reapers, which will not fail to be interesting, whenever it may come off, since both have defeated Hussey's in its best forms. Such a trial might have taken place on Keillor farm, as sufficient time was given by Mr Watson, in his challenge, to fetch the machine from the neighbourhood of Sunderland, where it was operating. It is quite possible that Mr M'Cormick was afraid of losing the £50, had he accepted the challenge; but it would have been quite competent for him to have undertaken the trial at Keillor, for the satisfaction of all parties, without accepting the challenge. His recent offer of £20 for a competition near Sunderland, was proposed, we apprehend, too late for the harvest. We regret the want of the only data which might have been furnished by a trial between Bell's and M'Cormick's machines, and which might have

afforded important hints in the construction of a perfect reaper prior to the next harvest. But whatever might have been the result of such a trial, it is certain that the public patronage has been directed to supporting the worst form of reaper now in use. The trials that have taken place suggest a feeling of regret that fifteen hundred of the worst form of machines have been placed in the hands of farmers in the course of a single season—that about £144,000 should have been thrown away in one year by farmers on a comparatively worthless machine.

Let us consider the construction of the machines now under notice, with the view of discovering the objectionable parts of each, so that a more efficient one might be constructed out of their elements.

We may premise that, when Hussey's and M'Cormick's reapers were exhibited at the Crystal Palace, we examined them as minutely as we were permitted, for Jonathan did not seem to like our prying too narrowly into the more hidden parts of their interiors. Perhaps he was in the expectation of a patent he was doomed never to receive. After such an inspection as we could give, we made up our mind in favour of Mr M'Cormick's; and its subsequent trial on Triptree Hall farm supported our opinion; for although the day, by reason of the rain, was anything but favourable to the operation of reaping, and the corn—a heavy crop—was but a little turned towards maturity, as well as being very wet, both machines had the same chance; and no doubt was left in the mind of any of the spectators that M'Cormick's did reap the strong wet unripe crop of wheat in a fashion, whilst Hussey's was at once entirely overcome by it. A subsequent trial on Mr Pusey's farm decided the Judges to award the Exhibition Medal to M'Cormick's as the better reaper of the two. In the face of such a decision, it seems strange that no fewer than three of the most eminent implement-makers of England should endeavour to improve and to push into use, by their known influence, Hussey's rather than M'Cormick's reaper, and thereby to give a wrong bias in that particular to the agricultural mind.

The cutting process is the most material part of any reaping machine. This process has hitherto been effected by only two modes, one by means of a uniform sharp-edged circular or polygonal instrument, and the other by that of shears. On the present revival of the reaper, the smooth-edged cutters have been abandoned and the shears adopted. Thus the ideas entertained by the late Mr Smith and by Mr Mann on the cutting process have been ignored, and that of the Rev. Patrick Bell adopted. The adoption of the shears in the American machines is not surprising, when it is borne in mind that the Americans have evidently adopted them from the Bell machines that found their way to America. In the shears adopted by all the machines, the form of cutting is different, though the result produced by each is the same.

The shears of *Hussey's* reaper consist of a series of triangular movable blades, having both edges sharpened; and they operate between an alternate series of triangular fixed blades, which are projected among the corn, to hold it firmly until cut, as the machine is advanced by the horses. The rapidity with which the shears are moved is above 500 revolutions of the crank-shaft in a minute. The moving power originates in a broad wheel revolving upon the ground, and bearing the principal weight of the machine. The machine is *drawn* forward by two horses yoked, on each side of a pole attached to the machine, to chains and swing-trees. The breadth cut by the shears is about 3 feet, and they cut the grain, while the horses walk in advance, to the right along the side of the standing corn. A boy guides the horses by riding on the nearest; and a man is seated above the closed-in machinery, whose duty it is to lay the grain as it is cut regularly upon a board, by means of a wooden rake, with which he pushes the cut grain off the board immediately behind the machine in quantities sufficient for a sheaf. The effect of the operation of the machine is to cut down a breadth of about 3 feet of grain, and to leave it in separate bundles immediately behind its path; and to accomplish this speedily, the horses must walk about four miles an hour. Thus equipped, the machine proceeds with apparent ease, moving round corners quickly, and cutting down a given space of standing corn in a very satisfactory manner, by going round it and leaving the stubble from 4 to 6 inches in length, and quite free of straws and grain. It is evident that any such machine as this must leave the most regular stubble the more level and uniform the ground is upon the surface. The machine is said to weigh 15 cwt. These present the more favourable aspects of this reaper; the objectionable ones are the following:—The great noise accompanying the progress of the machine indicates that severe friction in the machinery is strenuously opposing its advancement; and as a proof of it, the shafts of the wheels become greatly heated. The rapid motion of the gearing must wear down the machinery in a comparatively short time, and perhaps extensive repairs are requisite every year. Two horses are much distressed in working the machine; and even when a third is added, the work is too severe for them beyond two or three hours at a time. The driver riding on one of the two horses cannot guide them with precision in reference to the corn to be cut, as is evinced by the machine leaving strips of corn uncut in turning the corners of the breaks of standing corn. When a third horse is yoked in front, a boy is required to be mounted on its back, thereby increasing the cost of cutting; and the action of this horse, besides, often misleads that of the wheel ones in the turnings. The man sitting in the machine is very severely worked, in directing the cut corn on the board with the wooden rake, and in pushing the bundles of the cut grain off the board. This

work was severe even in the case of a short thin crop of standing wheat, which we saw cut at Ruchlaw in East Lothian; and a stout man present, who tried to work the rake, declared the labour to be very severe. In the case of a strong crop, it is utterly impossible for one man to *collect* the grain and to *push* it off the board—which is an unpleasant motion to make at any time, and especially with a rake, having the handle set at an acute angle with the head, and at the same time keep the reaper going at its full speed and capability. Such work, besides, cannot be well done, because, as he lays down the grain and pushes it off with the rake, the ears of the grain are apt to be laid down in drawn-out layers instead of in clusters. We heard a field-worker at Perth say, that it required more time to make the bundles into good sheaves, after this machine, than to gather it into sheaves after the scythe. This machine cannot be backed by the horses, since they have no attachment to the pole but by the collar chain; nor can the horses be yoked in a curricle form, which would effect the backing, since the driver must ride on one of them. The machine requires to be backed when the shears become clogged by the crop, in order to release them; and it must be pulled back by the strength of men after the machinery has been put out of gear. The shears are very apt to be clogged, and stop the machine, when they cut juicy grass or straw, or when the straw is wet; and such a result is not surprising, when we know that the sharp edges of the shears play into a groove in each side of the fixed triangular blades. Such a groove is very likely to become clogged up with the juice of green grass, newly cut; and the cut portion of the grass itself may stick in it, and wedge up the blades of the shears. The shears are cleared of obstruction by releasing the shaft by which they are moved out of gear. On the shears becoming blunt, they must be taken out and ground upon a stone, and then smoothened with a hone. When young clover occurs in a grain crop, this machine is often clogged up by it and brought to a stand still, causing much trouble and delay. On this account it does not operate satisfactorily on barley, nor even on oats, among which much weedy grass is found growing on the ground. It succeeds best with clean wheat straw; but if the crop is at all heavy, it cannot cut above 12 or 15 inches of it in breadth without being obliged to stop, on account of the severity of the work both to the man with the rake and to the horses. This effect we noticed distinctly amongst the wheat cut on the Muirton farm, at the comparative trial during the Show of the Highland Society at Perth. The bundles of cut grain being left in sheaves in the space of ground just cleared of its crop by the cutters of the reaper, the machine cannot cut another bout in the same direction until those bundles are bound into sheaves and stooked on another space, because the horses in the succeeding bout have to walk on the space of ground that had been occupied by the bundles just pushed off the board of the

machine. The machine cannot at once enter a field of standing corn and begin to cut it down, because the horses have to precede the cutters. A sufficient breadth to allow the horses to walk upon must therefore be cleared in every field, by the sickle or the scythe, before this reaper can be used. The machine cannot work well across high-crowned ridges, as the points of the shears are apt to plunge into the sides of the next ridge in crossing any open furrow. In such a case it must be worked along the length of the ridges. The best way to work the machine is to set off a break of the standing corn, sufficient, perhaps, for the reaping of one yoking; and if a field is small, it should be made of one break, and a clear space cut at once round its entire circumference. In cutting round a break of standing corn, the machine must go empty along the head-ridges when the ridges are high-crowned; but where they are flat, and the open furrows shallow, the machine will cut round the break without interruption. With thorough drainage, the ridges of the strongest soils may be made flat enough for the use of any reaper. Most of the objections to this reaper are of so serious a description as, in our opinion, to preclude its general adoption.

The cutting apparatus of *M'Cormick's* reaper consists of a series of fixed triangular blades, which are projected forward amongst the corn as the machine is moved onward, in order for them to take hold of it and keep it firm till the cutter severs each individual straw. The cutter is a strip of iron notched on one side into teeth, like those of the common toothed sickle. It is moved backward and forward by means of a cranked shaft, but at what velocity we have not learned. The cutting across of the straws of the crop is effected by the vibrating motion of the cutter, with its toothed edge operating against them, while they are held fast by the projecting triangular blades. When the notched teeth become blunt, which is but seldom, the strip of iron is removed, and its flat side subjected to the action of a grind-stone. The cutting saw is moved by means of the revolution of a broad wheel upon the ground, similarly to the shears in Hussey's, and it also bears the principal part of the weight of the machine. Two horses are yoked to this machine in a manner similar to that of Hussey; but as none of the horses are ridden upon, they might be yoked in curricle form, with a rod across their backs to enable them to back the machine easily. The driver sits on the machine and guides the horses by means of double reins, and has therefore a better command of them, in keeping them in the line of draught, than the mounted driver can have in Hussey's machine. The horses are placed in reference to the cutters, and walk along the side of the standing corn when the machine is in operation, the same as in Hussey's. A man sits above the closed-in machinery with his back to the driver, with a rake in his hand, by which he sweeps towards and past himself the bundles of grain as they acquire the size of sheaves off the board upon the cleared ground on the outside of the

machine. The rake is of the common form, having the handle at right angles to the head, which is furnished with long teeth. The man with the rake in M'Cormack's reaper has no occasion to lay the grain regularly down upon the board, that being done by means of a fan 6 feet in diameter, which, on revolving slowly, directs the cut grain with each successive arm by the upper part of the straw upon the board when the ears of grain fall clustered together. The ears of grain acquire this last position on being guided into it by the inclination of the arms of the fan downwards towards the farther side of the machine, closed in with canvass, causing the grain to fall more towards that farther side than the near one, until as much has accumulated there, according to the judgment of the raker, as will make a sheaf, when he gets quit of it, by sweeping it upon the ground. Having nothing more to do than this, the man is able to do it with the natural draw of the rake past him at intervals, even although these should necessarily be required in quick succession. Of the two men, the raker has the most to do, but they can take the raking and driving in succession. The placing the sheaves along the sides of the reaper enables it to continue its work with the cut grain lying on the ground. The progress of this machine is attended with little noise, and hence with little friction. It cannot pass across high-crowned ridges any more than Hussey's, nor can it open up a field of corn for itself; so that the same means of doing so, and the same plan of operations, are required for both machines. It makes a neat and clean stubble; but it has been remarked that the length of the stubble is not so regular as that left by Hussey's machine. We think the difference may be easily explained thus,—the large triangular blades, in being pushed among the corn, embrace more straws between them than naturally stand upon the space of ground below; hence part of the straws must assume an inclined position, whilst others still continue upright. When the straws in this assumed position are simultaneously cut through by the cutter, the inclined ones will leave a longer stubble than the upright ones; and hence arises the inequality in its length. This machine should progress as easily, and turn corners as readily, as Hussey's; and although its body is of larger bulk, the bulkiness is made up of light materials, being chiefly canvass. We are not aware of the weight of this machine, but it can scarcely be heavier than Hussey's. From the little we have seen of its operations, we are inclined to believe that it will supersede Hussey's.

The construction of *Bell's* reaper is as follows:—The cutter consists of a series of true shears, having one triangular blade, sharp on both edges, fixed; and another triangular one, also sharp on both edges, moving backward and forward upon it, cutting in both directions with a velocity not much exceeding one hundred strokes in a minute. The length of the shear-blades is 12 inches, while the

advance of the machine in one action of the shears is only 11 inches, so that the 12-inch blades have only to cut a breadth of 11 inches of corn, thereby insuring the cutting of every straw. The machine, when shut at both sides, can cut a breadth of corn of 6 feet, but when one of the sides is open to let off the cut straw, the breadth cut is 5½ feet; but the usual breadth is 5 feet. As the grain is cut, a fan of 3 feet in diameter directs it by the upper part of the straw, like that in M'Cormick's reaper, upon an endless web of canvass, which carries it to either side, as convenient, and deposits it in a continuous swathe upon the ground, on the outside of the space cleared by the shears, at an angle of about 30° to the line of motion. Two horses are yoked by chain and swing-trees to the end of a pole in connection with the framing, which is supported by an axle and two wheels, upon which the machinery travels. The horses are also connected with the pole by a breeching, by means of which they are able to back the machine with ease whenever required to do so. The motion of the shears originates with the revolution of the wheels, as does those of Hussey and M'Cormick, though in an entirely different manner; and this is a very ingenious part of the mechanism of this machine. The machine is *propelled* forward by the horses, their force acting in a direct line upon the cutting apparatus; whereas in Hussey's and M'Cormick's the line of draught is different, and is parallel to the line of motion of the cutting apparatus. In their case, a certain proportion of the horses' power must be sacrificed. On the end of the pole is suspended weights to balance the weight of the machinery before and behind the axle. One man walks on the ground and guides the horses with double reins, as well as steers the machine by means of the pole. The machine proceeds on its work without almost any noise. It cannot go across high-crowned ridges any more than Hussey's and M'Cormick's, doing its work best, of course, on level ground. The horses propelling, it can clear a way for itself in any field of standing corn. The stubble it leaves is 4 inches in length, and very clean. It cannot whip round a corner so cleverly as Hussey's or M'Cormick's, but, laying the swathe on either hand, it can go backwards and forwards on the same side of a break of corn, which neither of them can do. It can cut the standing corn while that which has been cut is lying on the ground, as can M'Cormick's, but not Hussey's. It is not so fatiguing as Hussey's to the horses, although among strong crops three changes of horses might be required in a day's work of ten hours. These are the favourable aspects which this machine presents, and the objectionable ones are:—It seems very heavy, although it is said to weigh no more than 12 cwt. It is a clumsy, ungovernable machine; but it does its work more quickly and quietly, and better, than one would expect from its appearance. It is difficult to place it in a right line for its work, because in accomplishing this the

horses have to move sideways to bring themselves into the line—a difficult motion for horses to make at all times, and which even horses accustomed to do take a long time in doing. Its great length, including the machine and its pole, requires for it a wide space to turn upon, and hence in a field where it cannot cross the ridges, a sufficient space at both their ends must be cleared before the guider of the machine can enter it easily into the ends of the ridges of standing corn. When the motion in a strong crop is greater than the endless web can carry away the cut corn, the machine chokes and stands still; and to obviate this inconvenience, a boy is useful in walking with the machine.

Now, the points which possess most interest for the farmer, in a comparison of these three reapers, since they all cut the corn well enough, are the *celerity* and *cost* of reaping an acre of standing and lying corn. It is self-evident, at the same speed of the horses, that as Bell's machine cuts a breadth of 5 feet, and Hussey's a breadth of 3, that Bell's will cut down 5 acres of corn in the time Hussey's takes to cut down 3. This single circumstance, independently of any other, ought to decide the superiority of Bell's reaper over the other. But, besides, this other circumstance should be taken into account: There is no doubt that Hussey's machine imposes too much labour on two horses, and that a third one is required when the crop is at all strong, and even then they cannot continue to work above two or three hours at a time. It must therefore at least employ one man and two boys in reaping. One man can work Bell's machine, although he is the better for being assisted by a boy, and two horses are quite sufficient for every three or four hours of work. Here, then, in the reaping process alone, Bell's reaper employs one boy and one horse fewer than Hussey's in any given time, and the work done by Bell's smaller force is greater than by Hussey's in the ratio of five to three; that is, if Bell's takes a day to cut 10 acres of corn, Hussey's will only cut 6 acres in the same time. But as Bell's does not in practice cut on an average of wheat, barley, and oats, more than 7 acres Scotch, or 8½ imperial, in a day, (day after day,) Hussey's in the above proportion will not cut, of these crops on an average, more in a day than 4 Scotch, or 5 imperial acres. The speed exerted under the excitement of a competition is not desirable, nor even attainable, under ordinary circumstances. Mr Bell's own people assured us that the quantity daily cut on the farm did not exceed from 6½ to 7 acres Scotch. Taking the wages of the men at 2s. 6d. a-day, the boys each at 1s. a-day, and the cost of the horses at what it may take to maintain them, say 1s. a-day each, the comparison between the two machines as to reaping will stand thus:—

HUSSEY'S.

One man at 2s. 6d., ...	£0	2	6	
Two boys at 1s. each, ...	0	2	0	
Three horses at 1s. each, changed three times,	0	9	0	
Five acres, . .	£0	13	6	= 2s. 8½d. per acre.

Bell's.

One man at 2s. 6d., ...	£0	2	6	
One boy at 1s., ...	0	1	0	
Two horses at 1s. each, changed three times,	0	6	0	
Eight and a half acres, .	£0	9	6	= 1s. 1½d. per acre.

As to the number of hands required to gather and stook the crop, Mr Bell's workers informed us that two men and eight women were quite competent to keep up with the machine when it cut the usual extent of 8½ acres a-day; and we prefer using the testimony of people of what they actually do at ordinary work, than to adopt results obtained under extraordinary circumstances, which serve only to create a state of excitement. Taking the wages of the men who stook at 2s. 6d. a-day, and of the women who gather and bind at 2s., the cost of setting the cut crop on foot will be the following, by Bell's machine:—

Two men at 2s. 6d. each, ...	£0	5	0	
Eight women at 2s. each, ...	0	16	0	
Eight and a half acres, .	£1	1	0	= 2s. 5¼d. per acre.
To which add the cost of reaping per acre, . . .				1s. 1½d.
Total cost per acre, .				3s. 7d.

At the exhibition of the machine on Mr Bell's own farm of Inchmichael, in the Carse of Gowrie, the number of persons employed and the expenses were as follows:—

Thirteen women and boys, at 2s. each, gathering and binding, ...	£1	6	0	
Three men stooking and guiding the machine, at 2s. 6d. each, ...	0	7	6	
Two horses at 1s. each, ...	0	2	0	
Twelve acres,	£1	15	6	= 2s. 11½d. per acre.

It should be borne in mind that the cutting of an acre imperial of oats, which occupied the machine only 40 minutes, or at the rate of 12 acres in 10 hours, was effected under exciting circumstances; and therefore we adhere to our rates obtained from the work-people, as being nearest the truth per day, on an average extent of all sorts of grain.

We have but few data to determine the number of hands required to take up the crop after Hussey's machine. It is stated that two persons fewer are required to do this than after Bell's, which is probable enough, since Hussey's cuts a less quantity in a given time, and gathers the crop into bundles; but we were informed by the women who took up the crop after Hussey's at Muirton, that it was more troublesome to them to make equal and proper-sized sheaves from the bundles, as laid down by Hussey's rakeman, than to gather the crop into sheaves from the swathe. Lord Kinnaird is stated to have given, at the meeting at Inchmichael, the expenses of reaping with Hussey's machine on his own farm, and they are as follows:—

Seven women and boys gathering and binding, at 2s. each,	£0	14	0
One man stooking, at 2s. 6d.,	0	2	6
Two men working the machine, at 2s. 6d. each,	0	5	0
Two horses, at 1s. each,	0	2	0
As above, five acres imperial,	£1	3	6 = 4s. 8½d. per acre.

It is also stated that four acres Scotch—the usual measure of land in the Carse of Gowrie—or 5 imperial, are as much as Hussey's machine was able to cut in a day on Lord Kinnaird's farm, which agrees very nearly with our own statement above of the capabilities of this machine.

The data we possess concerning the dimensions of M'Cormick's machine are furnished by the Driffield Farmers' Club, who tried it and Crosskill-Hussey's together on the farm of Kellythorpe. They represent M'Cormick's machine as 6 feet in width, and that it cuts a breadth of 5½ feet, and consequently it ought to cut down as much as Bell's in the same time. The Hussey machine they used cut a breadth of 4½ feet, which is wider than the one experimented with at Perth; and it would thus appear that this machine is made of different widths—that at Ruchlaw cutting 4 feet. At a speed of 2½ miles in the hour, Hussey's would cut down 7½ acres, while M'Cormick's would more than 9 acres.

A more important trial between M'Cormick's and Garrett-Hussey's machine was made on the farm of the Agricultural College at Cirencester, where both were worked day after day, until they cut down above 100 acres of grain. After so long a trial the results ought to be confided in, and the report says, that both machines cut down about the same quantity of corn, and that the stubble left by the Hussey machine was rather the neater; but that in raking up the left straws on the wheat stubble, those after M'Cormick's machine produced 2½ bushels per acre, while those after Hussey's gave 3½ bushels. It thus appears that M'Cormick's cuts cleaner than Hussey's. It also appears that Hussey's was driven at the rate of 4 miles an hour, and that the men and horses were severely tasked, while the speed of M'Cormick's was only 2½ miles an hour, and neither the men nor horses were distressed. In reality, therefore, M'Cormick's cut more than Hussey's in the same time. The driving strap of M'Cormick's came off frequently, to the annoyance of the workers, while Hussey's choked at times amongst the clover of the barley crop. The former inconvenience might be avoided, but we suspect not the latter.

After these statements of facts, which we have collected from various sources, the question naturally arises, Which of those machines should be recommended for general adoption? Before answering this question categorically, some preliminaries require consideration. According to our notions of what a reaping machine ought to effect, it ought not only to cut down the crop, but to

prepare it for binding and stooking. Unless it does both these, it will effect no more than the scythe; and more cannot be expected of any machine, since the making of bands, and the binding of sheaves, and the setting of stooks, are not likely to be effected by machinery; but all that machinery can effect ought to be effected. Mr Walker of Portleithen says that he had this harvest two contractors, who cut his corn for 5s. per acre. We have had it done by hired harvesters without contract for 6s. the acre. Now the difference between 5s. and 4s. 8¼d. per acre, according to Lord Kinnaird's data of the cost of working Hussey's machine, is no temptation to any farmer to expend a sum of money upon a machine which requires constant repairs while at work, and which will only be worked a few days every year. We regard, therefore, the attempt of both Hussey's and M'Cormick's machines, to lay the crop into bundles as it is cut, as a very laudable endeavour at arriving at such a result as ought to be effected by every reaping machine. But it is evident that Hussey's machine, in its present form, will never attain those objects, because the rakeman has not the time to lay down a full crop in the regular manner it ought to be; nor can he *push* away from himself to some distance, with the rake or any other instrument, a well-gathered bundle of corn, supposing it possible for him to gather it well, without ravelling it; nor will it do to place the bundles in such a position as to interrupt the progress of the machine; neither ought any machine of a locomotive character proceed at a speed of 4 miles an hour at any field-labour in which field-workers must necessarily take a part. For these reasons we consider Hussey's machine ill suited to reap our crops.

We perceive that M'Cormick's reaper avoids some of these inconveniences. It proceeds at no higher a speed than the plough, or at least when that implement is employed in the lighter operations of the field, such as horse hoeing. Its driver is more sure of guiding the horses correctly with double reins mounted on the machine than on horseback, and he, besides, does not distress the horse by its being obliged to carry him. The rakeman, not having to gather the crop, has time to sweep off the sheaves as they are formed. We observe that this operation, which is the only American invention, is not duly appreciated in this country. It is preferred to lay the crop into a swathe, rather than have it gathered into sheaves; and we have no doubt that the preference has arisen from having seen the rakeman of Hussey's machine subjected to the very hard labour he endures, as also the untidy manner in which he leaves the sheaves. We conceive, however, that they who prefer the swathe to the sheaf are in error, because the only other part of the reaping of a crop which any machine *can* effect beside the cutting is the gathering it into sheaves; and why should we not desire the machine to gather as well as to reap the crop? The gathering would effect a material saving in the cost

of harvesting the crop. We have seen that eight women are required to gather and make bands and bind the sheaves after Bell's machine. Were the machine to gather into sheaves, some of those hands would be saved. It perhaps occupies about the same time to take up a little of the cut grain, make it into a band, and lay it down on the ground, as to gather the corn into sheaf and lay it neatly into the band, as also to bind the sheaf and prepare it for the man who stooks it. It takes less time for the same person to make the band, gather the sheaf into it, and then bind it, than when three persons do those different things. On this account, we would estimate that three of the eight women could be saved, were the corn made into sheaves by the machine. The wages of the three women would amount to 6s., but the wages of the rakeman having to be deducted from this, the saving would be only 3s. 6d. on 8½ acres of corn. Were the machine to gather the corn into sheaves of itself, the rakeman would be saved, and the saving would be the whole 6s. on 8½ acres. We are of opinion that the machine could not furnish sheaves in all conditions of crop equal sized, whereas the judgment of the man would guide him in the time required to finish each sheaf, according as the crop was thin or otherwise. But the mere saving of a few pence per acre is not to be considered as the chief advantage to be derived from a perfect machine: it is the saving of three hands for every 8½ acres of grain; and it is probable that, with such a saving at each machine, the entire harvest might be executed by the people always residing upon the farm, without the aid of strangers. It would certainly be a very desirable result, were every farm to harvest its crop without adventitious aid. At present, the safety of our crops are too much dependent upon the immigration of strangers in the harvest season, and at any time much inconvenience is experienced in feeding and lodging a large number of migratory people. As M'Cormick's reaper holds out such a prospect to us, we ought to encourage it, until we attain that desirable end by other means.

Bell's machine cuts the grain in an excellent manner, but in so far as it does not aim at gathering it also, it is, in our estimation of its merits, deficient as a reaper. Perhaps an exchange of parts between Bell's and M'Cormick's machines might afford materials for the construction of a perfect reaper; and in endeavouring to make such a construction, the width of the machine should be regulated by the ability of a man to sweep off the sheaves in succession, in cutting down crops of such thickness and length as are common in this country—the American machines having no doubt been made to suit the American crops of grain, which usually stand thinner than ours on the ground; and it was most probable on this account that Hussey's machine cut down the thin and short crop of wheat at Ruchlaw so well as it did. The particular machine used there might have been made in Great

Britain, but in its principal parts it was just a copy from the American original.

But allowing that we do obtain a perfect reaper, according to the notions we have expressed above, the question is, whether or not such a machine would be of general use in this country? We should reply in the negative. Even although a reaper should clear for itself a way in any field it entered—and no reaper can be perfect unless it did so—it is evident that it cannot turn to one side or the other, after the first landing, without coming upon the standing corn, since its breadth is less than its length. A space for it to turn upon would require to be cleared by other means. It is also evident that frequent turnings are not suitable for a machine of the sort, so that in small fields and on short ridges it is not likely to be employed. We consider it quite practicable for it to cross ridges. Although the land will never be made perfectly flat on the surface—because we do not believe that the common plough will ever be laid aside for the turnwrist or any other, and it is not possible for it to make the entire surface of a field quite flat—yet it can make it comparatively so when dried with draining, so as four ridges might be always placed together, by ploughing two-out-and-two-in from a flat surface; and the open furrows of such ridges would then be shallow, and almost obliterated by the harrowing. It could not, besides, finish the reaping of any field, since it cannot find its way into the corners. In this last particular, both Hussey's and M'Cormick's could more nearly clear a field than Bell's. For these reasons, the reaper will be confined to large farms. It will never be made capable of reaping laid corn; and in case in any season the corn should be much laid, it will be comparatively useless. Hussey's passes over laid corn, when lying in any direction, or only cuts off the tops of the straw. Bell's cuts even much-laid corn very well when brought up against it, when it slides up upon the web; but it passes over it in the direction of the lay when flat, and it cuts a long stubble when the lay is across the line of progress. We have not heard how M'Cormick's affects laid corn. But should the reaper only cut down a pretty large proportion of the crop, such as even the half, it would prove itself a useful implement to the farmer. Supposing it to *cut down* and *gather* 8½ acres a-day, which could be done with *four* men and *five* women, it would be equivalent to *one acre cut, bound, and stooked by nearly each person.* To do the same quantity of work with the sickle, three and a-half persons (three reapers, with half the work of a binder and stooker) are required; and with the scythe, three persons (one scytheman, one gatherer, and half the work of a binder and of a raker) suffice. There is no way of demonstrating the superiority of a machine, which would both cut and gather a crop, over the ordinary method of reaping, than this mode of comparison. Hence we should not relax our exertions until we possess such a machine. Two such machines

would cut down 100 acres of corn every week with the people of the farm, which would make the harvest short and merry, instead of long and dreary, as it often is in this climate.

The Guano Question.—That guano has become a valuable ingredient in the agriculture of this country, every farmer is ready to affirm; nor will they deny that it has now become an indispensable means of maintaining the fertility of our soils, and of thereby increasing their prolificacy. In any negotiations, therefore, affecting a reduction of its price, it will not be in accordance with truth to aver that we can do without it, as it has been alleged.*

The price of guano has now settled down to the fixed price of £9, 5s. a ton. We believe that price was arrived at by ascertaining the cumulative values of the different ingredients of which guano is composed, and of the freight and charges. At that price, and at 3 cwt. per acre, the cost of applying guano to the land is about 30s. an acre; and it is a curious coincidence that the returns of crops manured with it amount to just about that sum. For example, 3 cwt. increase the wheat crop, according to Mr Hudson of Castleacre, 6 bushels; which, at 40s. the quarter, just gives a return of 30s. The use of guano, at present, may thus be said to be accompanied with no profit to the farmer, so that every shilling of reduction in its price below £9, 5s. a ton, would be so much gain to him. Now, how is a reduction of its price to be effected?

It appears that the ascertained quantity of the guano deposits amounts to thirty millions of tons, besides those not yet surveyed and estimated; and deposits are being daily formed, so that the supply seems inexhaustible. The quantity imported into this country in 1851 was 130,580 tons; so, at that rate, the present deposits could not be removed to this country in less time than 230 years. The whole of these deposits, and perhaps as much more, belong to the Peruvians; and no country where rain falls can supply guano of as good a quality as Peru can; and, of course, no other country will receive so high a price for its guano. Being thus secured of the guano trade, it is their interest to obtain as much money for their commodity as they can procure. They started the trade at £20 a ton. When guano was obtained from Ichaboe, the price of Peruvian fell from £20 to £10 a ton; but, independently of that, the Peruvians could not long exact a price above the cost of the ingredients of which the best guano is composed. Now, it is obviously the interest of the Peruvians to encourage the trade in guano to this country; and were they in a situation merely to impose an export duty on guano, they would

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* See BULLER's *Remarks on the Monopoly of Guano*, p. 21.

derive a handsome revenue from the trade, at one pound a ton of duty, were the importation doubled or tripled.

But, unfortunately both for the Peruvians and this country, they cannot allow the guano to be taken away at a small export duty. The British creditors of the Peruvian nation will not allow them to do it. Their debt must be paid, principal and interest, before the Peruvians can extend their trade in guano. £1,200,000 of the debt was contracted in 1822, and £616,000 more in 1825. The rate of interest agreed on was 6 per cent; but no dividends were paid from October 1825; so from that date to 1849 the interest accumulating on the above sums amounted to £1,816,000. The liquidation of the debt "was, in fact, considered almost a hopeless case. At last the discovery of the guano deposits,"—the discovery, rather, that guano was a valuable material in this country,—"which were found to be an enormous source of revenue to the State, gave new spirit to the cause; and, after repeated remonstrances, in January 1849 rapid progress was made in an arrangement." * The arrangement created a fund of active debt of £1,800,000, being the original debt, at 6 per cent; and a deferred debt of £1,900,000, being the accumulation of interest at 3 per cent. The active debt is in course of liquidation just now, the dividends being regularly paid, and a part of the principal cancelled every year. Both kinds of debt amount at present, (1852,) to £3,300,000. The guano sent to this country under consignment to Messrs Anthony Gibbs and Sons is sold at £9, 5s.; and, after deduction of the charges, the value actually received for it was, in 1851, £4, 4s. 7½d. a ton, with which the dividends of stock are paid, the debt redeemed, and half the amount of sales is sent to the Peruvian Government.

Thus :—

Dividends at 6 and 3 per cent,	£147,000
Sinking fund on £1,400,000 at 1 per cent,	14,000
" " on £1,900,000 at ½ per cent,	9,500
Half amount of sales in 1851,	107,000
Sum to be annually paid from guano,	£277,500

At the present rate of importation and redemption, the debt will take, perhaps, fifty years to be paid off.

For such a period it will not do for the British farmer to wait. It is his interest that the debt should be liquidated in the shortest possible time, that he may obtain as much guano as will subserve his purposes every year to the fullest extent. Different plans have been suggested to attain this end, the favourite one of which seems to be, that our Government shall guarantee to the British bondholders the payment of their dividends, and take the Peruvian government into their own hands.

Whilst our Government should guarantee their annual pay-

* FORTUNE's *Epitome of the Funds*, p. 218.

ments to the bondholders and the Peruvians, they are advised at the same time to lower the import duty on guano to £2, 10s. a ton. To realise the above payments at that reduced rate of duty would require a considerable increase in the quantity of guano imported; and even after the importation increased in the ratio of the reduction of the duty, the sum left for the liquidation of the debt would not be increased. The increased importation of guano at a small reduction of duty is problematical, as we may see by reviewing the accounts of sales effected by Messrs Gibbs and Sons in 1851. In that year they imported 130,580 tons, and realised £371,899, 9s. 4d., at a duty of £4, 4s. 7½d. a ton, which sum was more than sufficient to meet all the demands of the creditors and the Peruvian government upon it. But, after all, it appears that the Messrs Gibbs and Sons only sold last season 87,891 tons, and had 42,689 tons on hand to meet the imports of 1852, which shows that the actual consumption of guano in this country is not very great; and even if that were doubled, the lower duty of £2, 10s. a ton would only realise £439,855—a sum quite sufficient, no doubt, to meet the demands of creditors, but certainly not large enough to leave a balance to liquidate the debt in any reasonable length of time. The reduction of duty to £2, 10s. a ton would make the price of guano £6, 15s. a ton; but of this sum the freight and charges are set down at £5 a ton. It is believed that, were the quantity to be brought to the country doubled, the freights would be reduced to £4 a ton; and after the ship canal shall be opened across the isthmus of Darien, the short voyage might be compensated by a freight of £3 a ton. If these hopes were realised, the guano would be obtained for £4, 15s. a ton. But the price might be considerably reduced below that sum at once; for let the Government pay off the Peruvian debt at once, and let the guano be brought into this country for £1 a ton of import duty—a sum quite sufficient for the Peruvian to realisé a large revenue from their guano deposits—and it would be all profit to them. We maintain that the agriculturists of this country have a right to make such a demand upon the Parliament—to pay for them the sum of three millions in one year—when they were deprived of ninety-one millions a-year for ever by a bold act of the Legislature. With such an arrangement, embracing the probable reduction of freight and a trebled importation at that low duty, the guano could be imported for £4 a ton; a sum which would most probably induce the use of a trebled quantity, and would leave a profit of not less, perhaps, than £6 upon every ton used by the farmer, by a corresponding increase of produce. Were such a state of things realised, the inducement to use guano largely in every department of culture would indeed be great; it would prevent the importation of all inferior guanos, and it would put an end to the shameful, though, we suspect, profitable practice of adulteration and manufacture.

PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 5.	44 8	25 9	21 6	30 6	31 4	30 7
12.	44 5	25 2	19 11	30 10	35 0	30 8
19.	43 1	25 4	20 2	31 2	33 3	31 10
26.	43 11	24 10	20 2	31 0	33 2	31 3
July 3.	44 6	26 2	19 7	31 4	37 7	31 5
10.	45 3	31 4	17 11	31 6	35 4	33 8
17.	43 2	25 8	18 11	31 1	34 0	32 6
24.	43 2	26 8	19 2	31 0	35 8	33 3
31.	42 8	25 5	20 7	30 8	34 5	32 3
Aug. 7.	45 2	24 0	20 0	30 10	31 7	33 2
14.	44 0	24 4	19 3	30 4	32 8	31 8
21.	45 7	23 11	17 5	29 10	34 4	30 6
28.	49 1	32 3	20 4	31 0	32 3	33 9

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.
June 2.	43 2	30 6	22 10	33 0	33 7
9.	43 0	29 3	22 10	34 2	34 11
16.	42 5	30 3	22 6	33 0	33 4
23.	42 4	30 0	21 5	32 10	33 5
30.	42 5	29 1	20 9	32 2	32 10
July 7.	42 1	26 7	21 0	33 1	33 9
14.	42 0	26 6	21 4	33 0	33 7
21.	41 11	30 0	20 11	34 6	35 6
28.	41 5	26 10	20 10	33 0	33 6
Aug. 4.	39 6	24 3	19 3	32 0	32 6
11.	40 11	27 2	19 7	31 8	32 2
18.	43 9	26 3	20 11	32 6	33 10
25.	42 2	27 5	20 10	32 1	33 6

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 5.	41 11	23 6	23 3	28 7	29 10	33 1
12.	41 3	24 6	20 6	28 10	30 4	32 6
19.	40 6	26 1	20 10	28 6	30 1	30 0
26.	41 9	26 6	18 7	27 2	32 2	34 10
July 3.	42 5	26 2	22 5	27 6	31 4	32 0
10.	40 7	27 1	19 3	27 9	30 8	33 4
17.	40 9	26 8	18 2	27 1	32 6	35 6
24.	41 10	26 4	18 7	25 0	31 6	35 0
31.	42 10	25 9	22 4	23 10	32 4	34 7
Aug. 7.	43 1	25 4	17 7	24 2	33 1	34 0
14.	42 6	25 3	20 5	24 6	33 4	34 6
21.	43 1	25 6	18 4	25 1	32 8	35 0
28.	42 1	24 11	21 2	25 6	33 9	36 0

DUBLIN.

Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bere, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour, p. barl. 9 st.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.
June 2.	22 6	13 6	11 6	11 0	14 5
9.	23 3	14 0	11 9	11 3	14 7
16.	23 11	14 2	12 3	11 2	14 8
23.	23 2	13 10	12 0	11 3	14 6
30.	23 9	13 6	11 8	10 9	14 5
July 7.	24 7	14 2	12 2	11 2	14 9
14.	24 6	14 4	11 10	11 1	14 8
21.	24 7	13 4	11 3	11 3	14 6
28.	24 11	12 9	10 4	11 8	14 7
Aug. 4.	23 2	12 2	9 6	11 0	14 5
11.	23 9	12 5	9 7	10 10	14 6
18.	25 7	12 6	9 9	10 6	14 10
25.	26 8	12 3	9 1	10 2	14 6

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vic., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 5.	40 7	40 9	27 5	28 0	20 8	20 0	30 6	30 5	31 0	29 8	31 6	31 0
12.	40 11	40 10	27 6	27 10	20 0	20 0	29 8	30 3	31 2	29 11	31 10	31 4
19.	40 9	40 9	27 5	27 9	20 2	20 2	30 7	30 2	31 9	30 2	32 0	31 7
26.	40 10	40 8	27 6	27 7	20 0	20 2	31 0	30 4	31 9	30 7	32 4	31 9
July 3.	41 4	40 10	27 5	27 6	19 10	20 1	32 4	30 8	33 2	31 0	33 1	32 1
10.	41 5	41 0	28 3	27 7	19 9	20 1	32 6	31 1	33 3	32 0	34 0	32 1
17.	41 0	41 0	27 0	27 6	19 11	19 11	30 1	31 0	30 11	32 0	34 5	32 11
24.	40 7	41 0	28 2	27 7	19 9	19 11	28 9	30 10	34 5	32 7	33 10	33 3
31.	40 0	40 10	27 8	27 8	20 6	19 11	29 11	30 9	33 5	32 10	34 2	33 8
Aug. 7.	39 7	40 8	27 3	27 7	20 0	19 11	29 7	30 6	30 6	32 8	33 9	33 10
14.	39 7	40 4	27 5	27 7	19 6	19 11	30 3	30 2	31 4	32 4	33 7	34 0
21.	41 2	40 4	27 4	27 6	19 3	19 10	29 4	29 7	29 10	31 9	33 2	33 10
28.	43 7	40 9	28 2	28 7	20 3	19 10	29 9	29 7	31 1	31 9	34 4	33 10

FOREIGN MARKETS.—Per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
June ..	Danzig	41 0 - 47 0	17 6 - 25 6	12 6 - 16 9	28 6 - 32 6	24 6 - 34 0	22 6 - 28 0
July ..	Danzig	38 6 - 44 0	18 6 - 26 0	13 6 - 17 6	27 6 - 31 0	25 0 - 32 0	21 0 - 27 6
Aug. ..	Danzig	40 6 - 47 0	18 6 - 27 0	12 0 - 15 6	26 6 - 30 0	24 6 - 31 6	22 0 - 27 0
June .	Hamburg	32 0 - 40 6	20 0 - 25 6	13 6 - 16 6	26 6 - 32 6	28 6 - 35 6	23 0 - 28 6
July ..	Hamburg	33 6 - 41 6	19 0 - 24 6	12 6 - 16 0	27 6 - 31 0	25 6 - 32 0	23 0 - 27 6
Aug. ..	Hamburg	35 6 - 42 0	22 6 - 28 3	11 6 - 14 6	25 6 - 30 6	26 0 - 33 0	22 0 - 27 0
June ..	Bremen	32 0 - 38 9	18 6 - 25 0	13 6 - 16 9	24 6 - 29 9	27 6 - 35 0	21 6 - 26 0
July ..	Bremen	30 6 - 37 6	19 9 - 26 6	12 6 - 16 0	23 6 - 28 6	26 0 - 33 0	20 6 - 25 6
Aug. ..	Bremen	33 0 - 39 6	20 6 - 27 6	11 6 - 15 0	22 6 - 27 0	25 6 - 32 6	20 9 - 25 9
June ..	Königsberg	32 6 - 38 6	17 6 - 24 0	14 6 - 18 0	22 6 - 26 0	24 6 - 31 0	21 6 - 29 0
July ..	Königsberg	34 6 - 43 0	18 0 - 25 6	14 0 - 17 6	21 6 - 25 0	23 6 - 30 9	20 6 - 28 6
Aug. ..	Königsberg	35 6 - 44 0	19 6 - 26 6	13 6 - 16 6	22 0 - 24 6	22 6 - 30 0	20 0 - 27 6

Freights from the Baltic, 2s. to 3s. 3d.; from the Mediterranean, 5s. 6d. to 8s.; and by steamer from Hamburg, 1s. 3d. to 2s.

THE REVENUE.—From 5th July 1851 to 5th July 1852.

	Quarters ending July 5.		Increase.	Decrease.	Years ending July 5.		Increase.	Decrease.
	1851.	1852.			1851.	1852.		
	£	£	£	£	£	£	£	£
Customs	4,318,218	4,502,164	183,946	..	18,715,072	19,011,774	296,702	..
Excise......	3,419,810	3,443,516	23,706	..	13,219,609	13,206,404	..	13,205
Stamps.....	1,525,492	1,626,826	101,234	..	6,040,249	6,002,860	..	37,389
Taxes	2,045,231	1,503,707	..	541,524	4,322,681	3,149,702	..	1,172,979
Post-Office ..	240,000	230,000	..	10,000	891,000	1,041,000	150,000	..
Miscellaneous	121,241	262,189	140,948	..	312,333	522,948	210,615	..
Property Tax	976,881	1,056,991	80,110	..	5,353,425	5,363,910	10,485	..
Total Income	12,646,873	12,625,393	529,944	551,524	48,854,369	48,298,598	677,802	1,223,573
	Deduct increase			529,944	Deduct increase......			677,802
	Decrease on the qr...			21,580	Decrease on the year..			545,771

PRICES OF BUTCHER-MEAT.—Per Stone of 14 Pounds.

Date.	LONDON.		LIVERPOOL.		NEWCASTLE.		EDINBURGH.		GLASGOW.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1852.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
June ..	4 3 - 6 3	4 6 - 6 6	4 0 - 6 0	5 0 - 6 6	4 0 - 6 0	4 3 - 6 3	4 6 - 6 3	5 3 - 6 3	5 3 - 6 6	5 6 - 6 6
July	4 4 - 6 6	4 6 - 6 6	4 2 - 6 3	5 3 - 6 6	4 3 - 6 3	4 6 - 6 6	4 6 - 6 3	5 3 - 6 3	5 6 - 6 6	5 6 - 6 6
Aug. ..	4 3 - 6 3	4 6 - 6 6	4 3 - 6 3	5 3 - 6 3	4 3 - 6 3	4 6 - 6 3	4 6 - 6 0	5 6 - 6 3	5 6 - 6 6	5 6 - 6 6

PRICES OF ENGLISH AND SCOTCH WOOL.—Per Stone of 14 Pounds.

ENGLISH.	s. d. s. d.	SCOTCH.	s. d. s. d.
Merino, ...	14 0 to 18 0	Leicester Hogg, ...	12 6 to 18 6
.. in grease, ...	10 0 to 14 6	.. Ewe and Hogg, ...	10 6 to 15 6
South-Down, ...	15 6 to 18 6	Cheviot, white,..................	12 6 to 15 0
Half-Bred, ...	11 0 to 15 0	.. laid, washed, ...	8 0 to 10 3
Leicester Hogg, ...	12 6 to 19 0	.. unwashed, ...	6 9 to 8 9
.. Ewe and Hogg, ...	10 6 to 15 6	Moor, white,.....................	6 6 to 8 9
Locks, ...	7 0 to 8 6	.. laid, washed, ...	5 9 to 7 6
Moor, ...	5 6 to 6 6	.. unwashed, ...	5 3 to 6 3

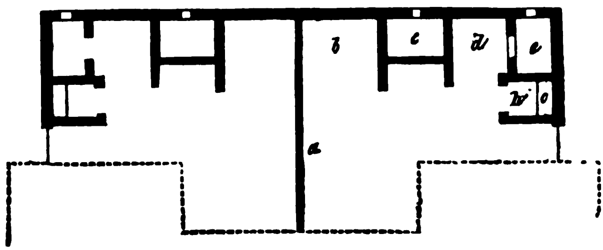
AGRICULTURAL ARCHITECTURE AND ENGINEERING.—No. VII.

By R. S. Burn, M.E., M.S.A., Author of "Practical Ventilation," "Hints on Sanitary Construction," &c.

(*Continued from* p. 441.)

Before proceeding to illustrate and describe the remainder of the examples of various structures we have selected, we shall give the few detail drawings of those examples presented in our last, which we think will be of some practical use. And first as to the plan showing arrangement of out-buildings for the house in Plate I., which was omitted to be given in last number. In fig. 103,

Fig. 103.



which is a sketch of it, the dotted line represents the outline of back of two houses;—*a*, is the "yard;" *b*, "receptacle for coals," covered in at top by a continuation of boarded roof which covers the "hen-roost," *c*; "tub shed," *d*; "ash-pit," *e*; *h* is the "water-closet;" the rain-water cistern extends over water-closet and ash-pit. Fig. 104 is part of "transverse section" of

Fig. 104.

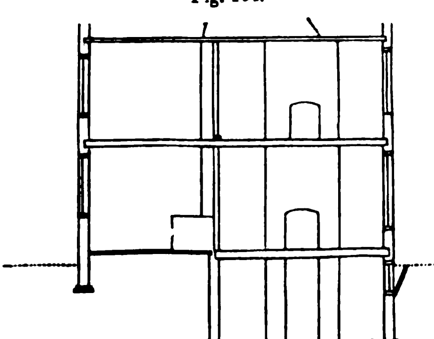
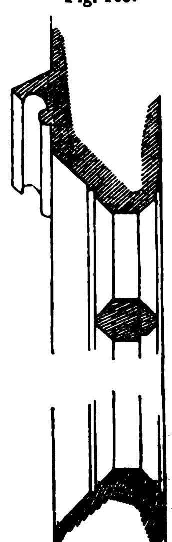


Fig. 105.



same house, Plate I., showing cellar, living-room, and bed-room floors. Fig. 105 is vertical section of living-room window. Fig. 106 is a suggestion for living-room fireplace.

Fig. 106.

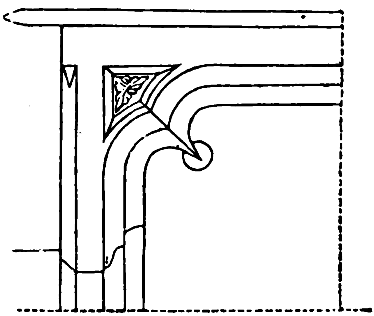


Fig. 107.

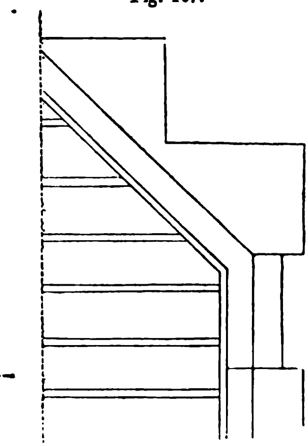
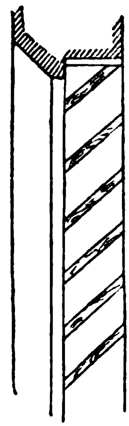


Fig. 108.



We now give a few detail drawings of row of cottages from figs. 85 to 89. Fig. 107 is a part elevation, and fig. 108 part section

Fig. 109.

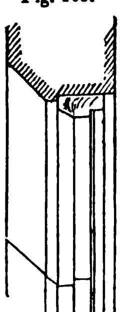


Fig. 110.

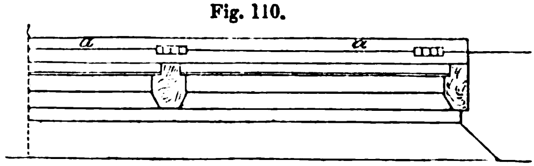
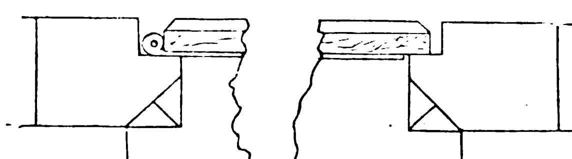


Fig. 111.



of "louvre" in gables. Fig. 109 is section of upper half of window in living-room, and fig. 110 half plan of ditto; *a a* shows the hinged shutter, forming a small work or flower table by day; fig. 111 is plan of front door; fig. 112, section of upper part of ditto; and fig. 113, elevation of interior of ditto.

Fig. 112.

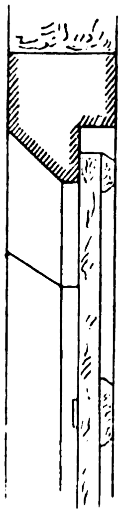
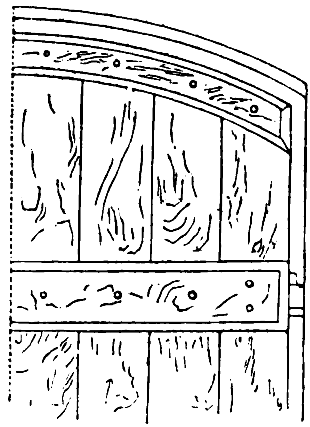


Fig. 113.



In Plate II. in this Journal for October 1852, and in Plates III. and IV. in this Number, we give sketches illustrative of a design for a farm-house of a superior class, the arrangement of which may present some claims to consideration. In Plate II. we give front elevation and ground-plan, drawn to a scale of one-eighth of an inch to the foot; in Plate III., back elevation and chamber plan to same scale; in Plate IV., end and side elevations, and front section, showing roof and attic floor to same scale; and plan of roof and attic floor, and cellar plan, to a scale of one-sixteenth of an inch to the foot. The following are the specifications of the required fittings, &c., which may be modified according to circumstances:—

Excavator.—To dig out and cart away the ground for the footings, foundations, areas, drains, &c., dig out and remove the ground under the whole of ground-floor, to the depth of 18 inches at least, from the under side of joists. Fill in, ram, and well consolidate the ground to all footings, and cart away all superfluous earth and rubbish.

Bricklayer.—The whole of the walls to be constructed of good, sound, hard, well-burnt stock bricks, laid in English bond in mortar, composed of one-third well-burnt stone-lime, and two-thirds of sharp clean river sand, and no four courses to rise more than ¾ inch beyond the collected height of the bricks. No variation to be made between the inside and outside work, except that the work intended to be plastered is to have the joints left rough. Lay a course of countess slate, bedded in cement, round the whole of the external and party walls, at the top of footings, to prevent damp rising. The fronts on each side of the house to be faced with red bricks, of an even and uniform colour, and finished with a neat trowel joint. (This specification is drawn up for brickwork, but where stone is plentiful, it may be modified accordingly.) Form all fire-openings with camber arches over the same, and trimmer arches where required for front hearths; carefully gather in the chimney-throats, and carry up the flues, (see remarks on Chimneys,) and the stacks carried above the roof, and set angularly, as shown in elevations. Bed in mortar all bond-timber,

plates, lintels, wood-bricks, and all other work required to be set in the brickwork; bed and point with lime and hair-mortar round all window and door frames; and back up with solid brickwork all stone and ironwork, &c. requiring it. Copper, stoves, and grates to be properly set with fire-bricks. Provide and lay a run of 4-inch circular drain-pipes with conical joints from scullery, and water-closets communicating with same.

Mason.—The whole of the dressings externally to doors, windows, strings, copings, &c., to be of Bath or other approved stone, worked accurately in accordance with drawings. Provide and fix to entrance-door two steps of rubbed Portland stone, and to back-door to garden two steps of tooled Yorkshire stone. Put to the fireplaces throughout, back hearths of 2-inch tooled Yorkshire stone, and to the principal rooms in ground story, front hearths of 2-inch rubbed Portland; to the kitchen and bedrooms throughout, front hearths of 2-inch rubbed York stone. Provide and fix to rooms on ground-floor, marble chimney-pieces of appropriate design, and to the bedrooms, Portland box chimney-pieces. The kitchen to have plain Portland jambs to fireplace.

Lay the floors of scullery with 2-inch rubbed York paving, well bedded in sleeper walls 4½ inches thick, brought up to receive ditto. Fix in scullery a 6-inch Yorkshire slop-stone or sink, on brick bearers, with proper hole cut for grating of "trap." Fit up the wine-cellar with two tier of 2-inch York shelves, supported on half-brick bearers.

Carpenter.—The timber to be used to be good sound Baltic, Danzig, Riga, or Memel fir, well seasoned, and free from sap, shakes, and other defects; to be cut square and true to the several dimensions and lengths hereafter to be specified; and no timbers to be fixed more than 12 inches apart, or to have a less bearing than 4½ inches on the walls. Provide all necessary wood-bricks to doors and windows, with every required preparation for fixing grounds, battens, and joinery. Lay a tier of wall-plates under each floor, of joists $4 \times 2\frac{1}{2}$, well scarfed and secured together in lengths, and united to flues with an iron tie notched in, and nailed to bond—care being taken that no timber comes within 9 inches of any flue.

The joists to rooms over cellars to be 8×2, trimmers 8×3; the other rooms on ground-floor to be of fir $3\frac{1}{2} \times 2$, on oak sleepers $4 \times 2\frac{1}{2}$, laid on sleeper walls brought up to receive them. The joists to upper floor to be 7×2, trimmers 7×3; and all floors, when properly fixed to a true level, are to have two rows of herring-bone shutting.

Frame the partitions with heads 4×3, sills 4×3, posts 4×4, quarters and braces 4×2.

The timbers of roof to be, ceiling-joists 3×2, binders 6×3, rafters 4×2, principal rafters 4×3.

Joiner.—Lay the floors of the principal rooms on ground-floor with 1-inch yellow deal, not more than 9 inches wide, close joints with splayed headings and mitred borders, and bradded with three nails in every joist in each board, and properly cleaned off at completion. Lay all other floors with 1-inch white deal, with splayed headings and mitred borders.

The entrance doorway is to have a solid wrought rebated and beaded fir frame, 4×4; the door to be of 2-inch deal, well hung to frame, with wrought-iron ornamental Gothic hinges; and to be furnished with iron closing ring and knocker; and to be fastened with a 9-inch draw-back lock, panel bolts and chain complete. The doors to principal room on ground story to be 1½-inch deal, 4-panel, chamfer moulded with stopped ends, both sides; hung with 3-inch brass butts, to 1¼ deal-wrought and rebated jamb linings, with inch framed grounds and moulded architraves; and to have brass mortice locks and china furniture. The doors to kitchen and scullery to be 1½ deal, 4-panel square, hung to 1¼ deal, wrought, rebated, and rounded jamb linings, with 3-inch butts, and to have 6-inch iron rim locks.

The door to garden to be 1¾ deal, bead, butt, and square sash door, with diminished styles and marginal squares, hung with 3-inch butts, to a fir, solid, rebated, and beaded frame $4 \times 3\frac{1}{2}$, and to have 1¼ deal lifting shutters with thumbscrews, stubbs and plates, and a 6-inch 3-bolt iron rim lock, and two 9-inch barrel bolts—weather-board and bracket, and water-bar at bottom on stone steps.

The doors to rooms on first floor to be 1½ deal, 4-panel chamfer-moulded both sides, and hung with 3-inch butts to 1¼ deal, wrought, rebated jamb-linings, with 1-inch framed grounds 4-inches wide, and single moulding to form architraves, and to have brass mortice-locks and furniture.

The doors on second floor to be 1¼ deal, 4-panel square-framed, hung with 3-inch butts to the inch, deal rounded, and rebated linings, and fastened with 6-inch iron rim locks. The windows to principal rooms on ground-floor to have deal-cased frames fixed in recess in stone jamb, and 1½ deal moulded sashes, double hung with lines, weights, and brass-faced pulleys; to have proper boxings with inch deal, bead, butt, back linings—1¼ two-panel moulded front shutters on splay, hung with 2½-inch butts in one height and prepared to cut with 1-inch back flaps hung with 2-inch strap hinges—1-inch deal moulded back elbows and soffits, and finished with grounds and architraves—to have brass spring-roller sash fasteners, shutter knobs and spring-plate shutter-bar.

The windows in kitchen and scullery to have 1½ deal sashes hung in frames, and 1½ deal lifting shutters, fastened with thumbscrews, stubbs, and plates.

The windows to bed-rooms to have sashes and frames of same description as lower rooms, but are to be finished with ¾ deal rounded linings and soffits, and 1¼ tongued and rounded window board.

Provide and fix ¾-inch deal narrow grounds and moulded skirting to rooms on ground-floor, blocked out to throw off chairs, and the plinth a board wide throughout.

The skirting to bed-rooms to be torus-moulded, 10 inches in height, fixed to narrow grounds.

Fit up the recess by side of fireplace in dining-room with 1¼-inch beaded closet front, and one panel dwarf folding-doors to ditto; best Honduras mahogany beaded top to ditto on bearers, and form skirting round same; put 1-inch shelf the whole size of cupboard, and put closet-lock and knob furniture to match doors, &c.

Fit-up in kitchen on one side of fireplace the whole height of room with 1¼ deal beaded closet front, six panel—the doors hung in two heights with 1½ butts, and on each door brass-knob button and cupboard lock. Provide the closet with three tier of inch-deal shelves on proper bearers, each shelf to be 1½-inch narrower than the one immediately above. Fit up the pantry with two tier of 1-inch deal shelves on proper bearers, and 5-feet run of meat-rail and hooks.

Fit up over sink in scullery a plate-rack 3 feet long.

Fit up in kitchen a dresser 7 feet long by 2 feet wide, with three drawers, foot-board, three shelves, cut standards, square legs, and moulded fascia complete; put a drawer-lock on one of the drawers, and drawer-knobs on all.

Fit up in fireplace recesses in bed-rooms where required, cupboards of same description as in kitchen, only the shelves to be movable.

The stairs to have 1-inch deal risers and 1¼ moulded heads, with moulded return ends and string carriages—1¼ sunk-wall string, with 1¼ cut and beaded outer-string—moulded Honduras mahogany hand-rail and turned spiral baluster. Fit up the water-closet with Honduras mahogany seat and riser, with clamped flap, and hung to a beaded frame with 2-inch butts and screws; cut a hole in seat for soil-pan, and a beaded ditto for pull, and put all round ¾ skirting 4 inches high.

Plasterer.—The ceilings throughout house to be lathed, plastered, floated, set fair, and twice whited. The walls to be rendered two coats, and set, and the partitions to be lathed with strong single laths, plastered two coats, and set fair for papering.

Run all external angles with Martin's cement.

Run round the scullery, kitchen, and larder a skirting in Atkinson's cement, 6 inches deep, and ½ inch projection from walls.

Run cornices round principal rooms in ground-floor of same description as that shown in detail drawing.*

Run round bed-room in first floor cornices 8 inches in girth, also to hall and staircase.

Slater.—Cover the whole of the roofs with the patent architectural tiles (Peake's terro-metallic) or countess slate, laid to a proper gauge on ¾ battens nailed with copper nails, with proper eaves-boards, &c. complete; the edges against the gables to be sawn clean and even.

Provide and fix in scullery a cistern of slate, put together with iron stays and copper bolts, to contain 200 gallons of water, from the filtering department of cistern, to supply kitchen range, &c.

Provide a cistern of like material, and make in roof, to contain rain-water for the water-closet, bath, &c.

* To be given in next Number.

Plumber.—Provide and fix to cistern in scullery, inch-lead supply-pipe, with inch ballcock, ball and bars complete, and inch waste-pipe.

Provide to bath 1-inch lead hot and cold service-pipe, and 1¼ waste-pipe, leading to drain and liquid-manure tank, with all necessary traps, handle, and index complete.

Provide and fix 2½ lead funnel-pipe to slop-stone in scullery, trapped into drain, with brass grating and trap complete. Lay on water from cistern to slop-stone with ¾ lead supply-pipe, and put ¾ brass bib-cock to same.

Supply the boiler of range from hot-water cistern placed in roof, with inch pipe communicating with ditto ; ¾ service-pipe to supply water-closet. Provide and fix to ditto a best white pan apparatus complete, with trap, service-box, &c., and 4-inch lead-pipe trapped into chains.

Fix 5-lb. lead flushings to all chimneys, walls, &c. throughout.

Smith and Bellhanger.—Provide, and hang complete in every respect, with all proper wires and cranks, separate bells to principal rooms on ground-floor, and all rooms on first-floor ; those on ground-floor to have ivory sunk lever pulls, and the wires concealed in zinc tubing.

Provide and hang complete from the side of entrance door a bell with sunk bronze handle. The bells to be collected in the passage leading to garden outside kitchen, and suspended to a deal-wrought and beaded bell-board, with pendants and labels complete.

Provide in principal rooms 3-feet register stoves, with movable bright bars and black ones ; and in bed-rooms, common bed-room grates, with cheeks complete. Provide and fix in kitchen a range with oven and boiler of wrought-iron, and in scullery a copper 2 feet in diameter.

Provide and fix to side of house cast-iron rain-water pipes, heads and shoes properly trapped into drain, and a row of iron eaves-gutters to roof where required.

Provide and fix a sufficient number of cast-iron air-bricks under lower floor of house for the admission of air.

Provide and fix two ornamental iron scrapers to external doorway, and ornamental knocker and hinges to door.

Provide and fix in bath-room a bath with all proper appurtenances.

Painter.—Paint the whole of the external and internal woodwork, iron, and whatever requisite, four times in good oil colour ; the hall, &c., flatted tint. Grain oak, and twice varnish the hall door in front.

Properly prepare, knot, and stop all the work, and leave the glass clean at completion.

Paper-hanger.—Paper the drawing-room and breakfast-room, in panels, with a paper of appropriate design, and the dining-room with an oak paper, with imitation perforated diaper style.

The bed-rooms to be covered with a paper of the value of   per yard cut close.

We present a few details of the house now described. In fig. 114 we give an enlarged sketch of the "apex of gable and finial;" in fig. 115, the "drip-stone" to "breakfast-room window," (see Plate II.) on an enlarged scale; and in fig. 116, enlarged sketch of the "string-course."

In Plate V. we give a series of drawings illustrative of a pair of cottages in the Italian style, the internal arrangement of which is shown in figs. 117 and 118. Fig. 117 represents the "ground-plan," in which entrance is obtained through the porch *D*, in which there are two closets or cupboards, *h* and *e*; *d* is the ash-pit and coal-place; *f* the water-closet, entered from the back. *A* is the living-room, 13 feet 6 inches by 13 feet, lighted by a three-light window in front. *B* is the scullery, back kitchen, or wash-house, 11 feet by 10 feet, lighted by a glazed door, *c*, as shown in Plate V., back elevation. The scullery is proposed to be cellared under, entrance being obtained by the steps entering at the returns, near mid-door. Entrance to bed-room floor is obtained at returns, near

Fig. 114.

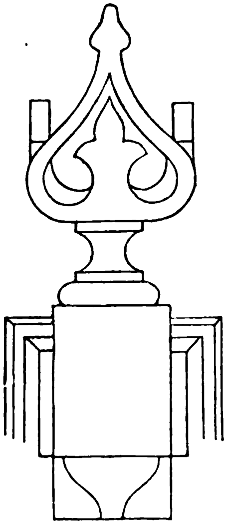


Fig. 115.

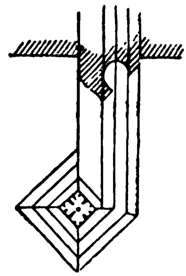


Fig. 116.

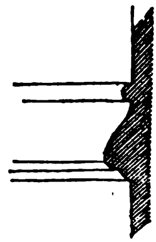
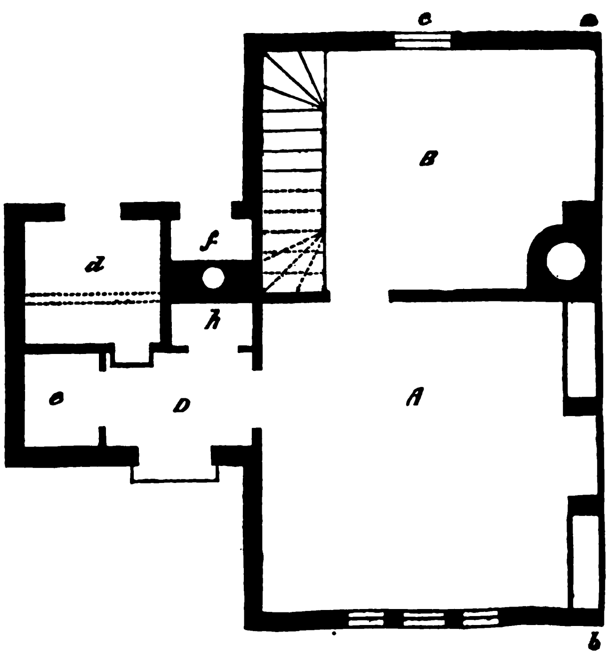
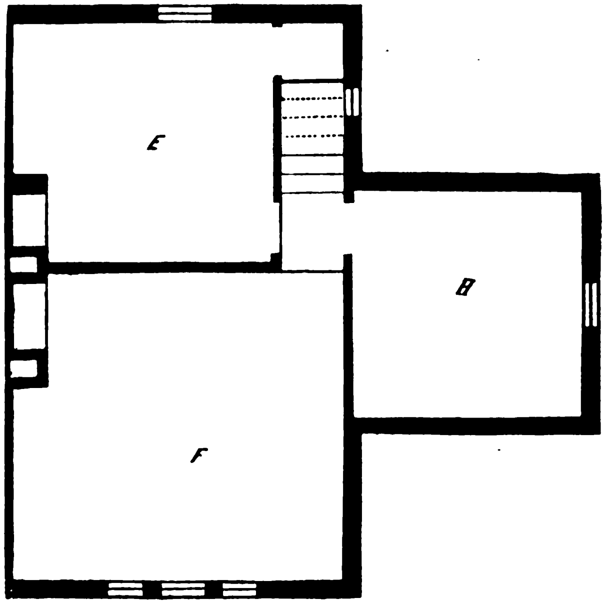


Fig. 117.



back door. Scullery is proposed to be fitted up with boiler, as shown, and slop-stone, running along back wall, from near corner of party wall and side of back door. In the bed-room floor,

Fig. 118.



shown in fig. 118, *F* is the front bed-room, 13 feet 6 inches by 13 feet; *H*, the children's bed-room over porch, &c., 9 feet 4 by 9 feet 4 inches; *E*, back bed-room, 11 feet by 10 feet. We here give condensed specifications of this plan.

Excavator.—Dig out the ground for all the footings and foundation walls. Fill in, ram, and well consolidate the same. Dig out the ground to the depth of 18 inches, under the lower floor, and remove the same; dig out cellar under wash-house, towards back wall, 6 feet 6 inches wide.

Bricklayer.—The whole of the walls to be constructed with the best hard-burnt stock bricks, laid in English bond. The mortar to be composed of one-third lime, and two-thirds clean sharp river or other approved sand or road-grit, and no four courses to be more than ¾-inch beyond the collected height of the bricks. Lay a course of countess slate, bedded in cement, round the whole of the external walls, and party walls at the top of the footings, to prevent damp rising.

The fronts to be faced with best malm seconds, or white Suffolk bricks, finished with a neat trowel joint.

The arches over windows to be of red brick, closely set, and trick-pointed.

The angle quoins and strings throughout to be of red brick.

Properly form all fire-openings, with camber arches over the same, and trimmer arches, where necessary, for front hearths.

The flues to be circular, of 9 inches diameter, well cemented at joints, and care-

fully bedded in mortar; and to be carried above the roofs, and finished as shown in external elevations in Plate V.

Provide and fix chimney-bars of wrought-iron, 3 × ½ inches, and 18 inches longer than the openings, properly fixed at the ends to fireplaces on all the floors.

Bed in mortar all bond-timber, plates, lintels, &c.; and bed and front with lime and hair mortar round all windows and door-frames.

Build all the dwarf-walls, piers, &c., to receive partitions and sleepers on basement floor, as shown in plans.

Provide and fix a run of 4-inch conical pipe drain from privy, and sink in kitchen, and make good the opening into liquid-manure tank.

Leave proper and sufficient openings for ventilation under joists of basement floor, and provide and fix cast-iron air-bricks in said openings.

Mason.—Put to the back and front doors solid tooled York steps 12 × 6, properly back-jointed and primed into brickwork, and properly mortised for door-posts.

Put to the fireplaces throughout back hearths of 2-inch York stone, and front hearths of 2-inch rubbed York stone.

Fix to the fireplaces throughout plain Portland box chimney-pieces.

Provide and fix in back kitchen a York stone sink, 1½ inches in depth, and rounded at corners, supported on proper brick bearers.

Carpenter and Joiner.—Lay the whole of the ground-floor with 1-inch yellow deal floor or fir joists 4 × 2 inches, and oak sleepers 4 × 2 inches.

Lay the chamber floor with 1-inch yellow deal folding floor or fir joists 7 inches by 2 inches, trimmers and plates, 4 inches by 2½ inches.

Frame the partitions throughout with heads and sills 4 × 3 inches, posts 4 × 4 inches. Door-heads, quarters, and braces 4 × 2 inches.

The roof to have ceiling joists 3 × 2, rafters 4 × 3, the ends projecting beyond wall, and framed to chamfered brackets, as shown in elevation and section. The windows throughout to have deal-cased frames with oak sunk sills 1½-inch ovolo-moulded sashes, double hung; with pulleys, weights, and lines complete.

The windows on ground-floor to have 1¼-inch clamped folding shutters, hung with hinges, and fastened with bow-latch fastener complete.

Provide and fix to the front entrance doorway a fir solid rebated and beaded frame, 4 × 3 inches, with transom moulded on front edge, and rebated for doors and fan-lights.

The door to be ¾-inch deal four panel, moulded one side, and hung with 4-inch wrought-iron butts, and fastened with latch and barrel bolts complete.

The doorway in back kitchen to have a fir solid rebated and beaded frame.

The door to be 1¾ deal, square framed sash-door, with diminished styles, hung with 3-inch butts, and to have 1¼ deal lifting shutters, with thumbscrews, stubbs, and plates. The door to be fastened with latch and barrel bolts.

The doors to all the rooms throughout to be 1½ deal, four-panel square framed, hung with 3-inch butts and screws, to 1¼ deal-wrought, double-moulded, and rebated jamb-linings, and fastened with common iron rim locks.

The door to water-closet to be 4¼ deal, beaded and ledged, hung with 3-inch butts to a solid fir frame, and fastened with latch and barrel bolt.

The door to ash-pit to be of same description, and hung to 1¼-inch rebated and jamb-linings.

Provide on each side of fireplace in living-rooms, cupboards, to have 1¼-inch deal beaded points, and 1¼ deal four-panel square panel doors, hung with 2½-inch butts, and fastened with turn-buckle fastening, and cupboard locks complete; ¾ deal stops, 1-inch deal tops rounded on the edge, and three tier of inch deal shelves inside.

Provide and fix in entrance porch the whole height of story, 1¼-inch deal beaded closet front, in two heights, the doors hung with 1½ butts, and each door to have a brass knob turn-buckle fastening complete. The smaller closet in porch to have 1¼ deal two-panel square framed door, hung to rounded linings with 2½ butts, and fastened with turn-buckle fastener.

Provide and fix round the whole of rooms, porches, &c. a run of square skirting 6 inches high on narrow grounds.

The stairs to have 1-inch deal treads and risers, with rounded nosings properly bound to 1¼ deal strings; and to have 1-inch deal square bar balusters, and moulded deal handrail.

Fit up water-closet with soil-pan and trap, with inch-deal seat and riser.

Plasterer.—Render set the walls, and lath and plaster set the partitions. Lath, plaster, set, and white the ceilings, colour the walls of back kitchen, entrance porch, and water-closet stone colour.

Paperhanger.—Paper all the rooms not coloured with a light pattern.

Painter and Glazier.—Paint all the woodwork requiring it four times in good oil colour. The whole of the sashes to be glazed with 3ds crown glass.

Plumber.—The sink slop-stone in scullery to have 2-inch waste-pipe, with trap and grating complete, carried to drain, and to have a ¾-inch service-pipe leading from rain-water cistern, with bib-cock complete, the whole well secured with wall-hooks.

The ridge of roof to be covered with 5-lb. lead 12 inches wide, properly dressed down and fastened to deal-ridge rolls.

The valleys to have 5-lb. lead turned up, at least 7 inches under the slates.

The middle gutter to have 5-lb. lead, to turn up 9 inches under the slates.

Provide and fix to eaves of roof 3-inch eaves gutter, on iron brackets, to empty into the heads of the rain-water pipes, with the requisite arms, elbows, pipes, and shoes, to the same.

Smith.—To provide wrought-iron chimney bars $2\frac{1}{2} \times \frac{1}{2}$, 1-inch camber running through the jambs of fireplaces.

Provide bow-latch shutter bars to the shutters.

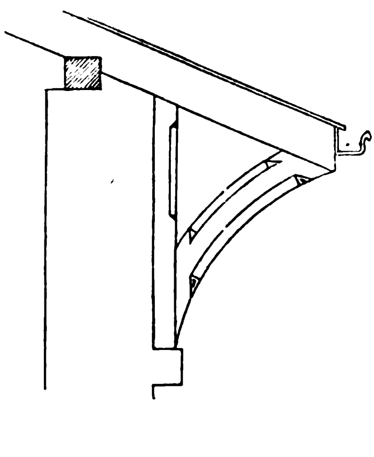
Provide a requisite number of cast-iron air-bricks.

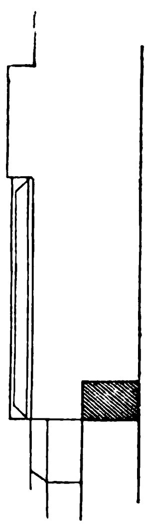
Provide and fix cast-iron boiler to scullery, common range to living-room, with common stoves to bed-rooms.

In fig. 119 we give a section showing bracketing of rafters on a large scale; and in fig. 120, a section of doorway, showing profile of keystone, &c.

Fig. 120.

Fig. 119.

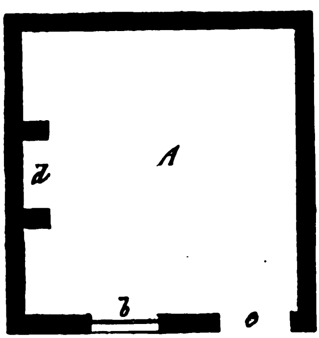




In concluding our remarks on the arrangement of cottages for the working classes, we propose to give a few illustrations, which may contain suggestions of some value, and as still farther elucidative of those principles which we have already detailed, as requisite to be attended to before the requirements of a higher standard of living than has generally been thought necessary can be

attained. These illustrations are arranged in progressive order, commencing with notoriously ill-arranged structures, and proceeding, by a series of advancing improvements, to what may be considered as structural arrangements of comparative perfection. In this way they may usefully serve as a series of simple rules, by which the various grades of improvement desiderated, by peculiar circumstances, may be easily carried out. By adopting from time to time, as opportunity serves, simple improvements in existing and badly arranged structures, such as our diagrams and remarks will indicate, a taste among the labourers of the lowest grade for a superior class of house may be gradually cultivated, and thus by degrees obviate one objection to giving to the labouring classes good houses, which has been often urged—namely that, in the well-arranged and more convenient house, greater scope would be afforded to the degraded and filth-loving habits, which so unfortunately and frequently characterise them in less favoured localities. Although nearly all experience has gone to prove, that improved structures bring at once with them improved habits of living, still we see many advantages in gradually weaning the taste of the lower classes from debasing methods of life, by progressive approaches to a higher standard. A glance at the series of sketches which we are now about to give, will best show how easily inducements are offered to the cultivation of habits in keeping with the outward rules, at least, of morality, by carrying out what in themselves may be considered as very simple arrangements.

Fig. 121.



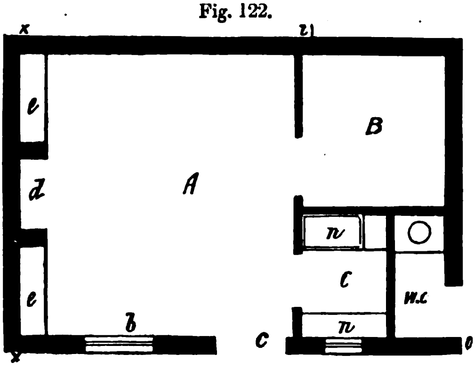
In fig. 121 we give a sketch illustrative of an arrangement too frequently to be met with in many of our agricultural districts. *A* is the only room, which might be described best in the words of "the comedian," as serving for

Parlour, kitchen, and—
Everything.

Entrance is obtained by the door *c* at once to the room; light is admitted by the one window *b;* the fireplace is at *d.* Compare this with the standard of efficiency which we have already detailed, and say if, in any one respect, the outward rules of decency can be attended to in such a barbarous structure. The construction of such a house as this is generally on a par with its arrangement. Let us see how we could bring this miserable place into something like a fit state for the reception of human beings, whose feelings

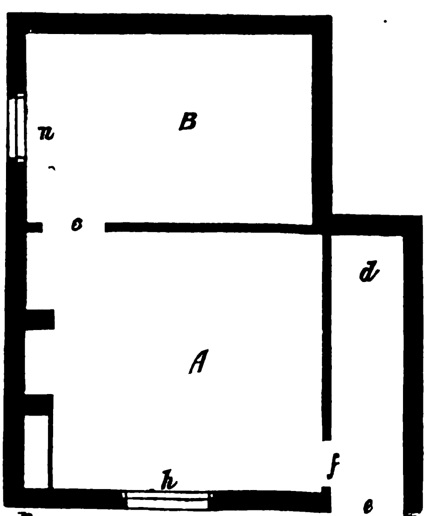
may be as naturally fine, and aspirations as pure and high, if not beclouded, and kept down by debasing influence, as those whose lives are led in palaces, and who are clothed in "purple and fine linen." In fig. 122 we show how improvements may be carried out; the outer walls are extended to *o*, as in the sketch, and carried up to the level of the eaves; a flat-boarded roof, with waterproof covering, may be thrown over the extension; partitions are run across this extension, as seen; and the following conveniences are obtained: A separate sleeping apartment *B* is obtained, entered from the living-room, *A*; a closet, *C*, containing at window a small slop-stone *n*, and cupboard *n*. Entering from the end, the water-closet is obtained in the small space left. Now, here we have a small cottage, containing much that is convenient, and in which at least a decent and comparatively comfortable life may be led. This arrangement may by some be considered as containing too many conveniences for the class for which it is designed; yet so far are we from holding this opinion, that we clearly think that any arrangement short of this is altogether barbarous, and as unfitted for Christian people as an Indian wigwam, or the round-topped hut of the Hottentot. Cupboards *e e* may be placed at each side of the fireplace *d*, thus affording those conveniences so useful, and yet so inexpensive in constructing. This cottage can be built in pairs, the wall *x x* being the party wall between the cottages.

Fig. 122.



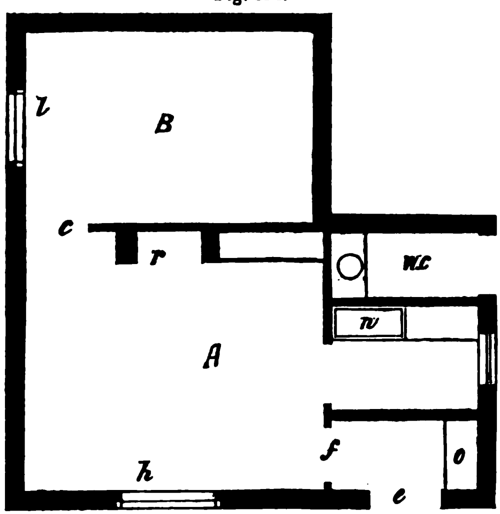
In fig. 123 we give a sketch of an arrangement frequently met with. In this case the living-room *A* is approached through the

Fig. 123.



door *f*, leading from the passage *e*, at the farther end of which, at *d*, we have too frequently seen a heterogeneous mass of utensils, not over pleasing to a fastidious eye, and suggestive at once to the observant mind of a sad want of household conveniences and comforts. The sitting-room *A* is lighted by a window in front, *h*. A bed-room *B* is provided, entered from the living-room *A*, and lighted by a window at *n*. Inasmuch as the living-room is not entered from the exterior at once, as in fig. 121, and a bed-room is provided, this arrangement is an improvement on that given in fig. 121. But a glance at it, bearing in mind our former remarks, suffices to show how miserably deficient it is in labour-saving and decent appliances. Fig. 124 details an arrangement which will cost very little more in absolute material than fig. 123, yet containing those conveniences so highly desirable. The living-room *A* is lighted by the window *h*; the fireplace *r* is placed opposite the window, thus giving facilities for having a fireplace in the bedroom *B*, the flue running up alongside with that of the fireplace in *A*; or the bed-room may be warmed by one of the methods we have previously detailed. The passage *d*, in fig. 123, is made wider in fig. 124, thus affording space for a porch, entered from the exterior by the door *e*, containing a cupboard *o*; space also for a scullery, provided with a slop-stone *n* and shelving, entered from the living-room, *A* : this closet is lighted by a small window, below which it might be advisable to place the slop-stone, instead of the situation we have given it in the sketch. More light would be thus afforded in carrying on the operations necessary. A water-closet is obtained in the space left at the extreme end, and entered as seen in the sketch. A rain-water cistern might be placed above the water-closet, a liquid-manure tank below it, into which the slops from the scullery may be led.

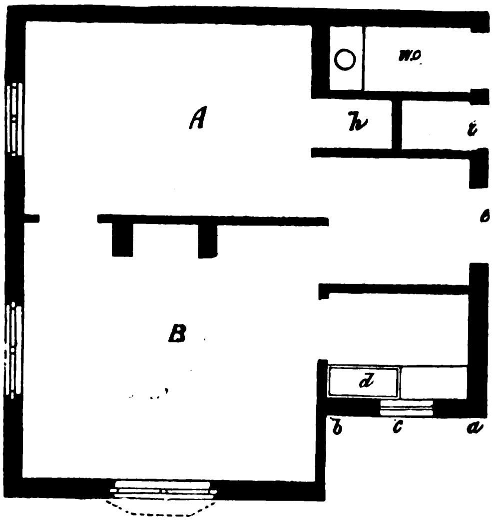
Fig. 124.



In these examples, the desideratum of having a distinct entrance to the bed-room has not been attained. In fig. 125 this has, how-

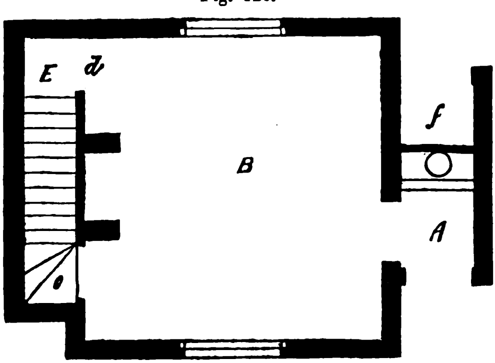
ever, been noticed in the arrangement. In this example, the projection *b a*, corresponding to that in fig. 124, is thrown back, so as to make the external wall of the water-closet be in a line with the back wall of the house. The entrance is at the side, at *e*, the porch being large enough to form a pleasant small sitting-room in summer-time. The sitting-room *B*, and bed-room *A*, are both approached by separate doors, as in the sketch. A small scullery is entered from the living-room *B*, lighted by a small window *c*, and supplied with slop-stone and shelving *d*. On the other side of porch, a small wardrobe-closet *h* is obtained, entering from bed-room *A;* a coal-place *v*, and water-closet, entering from end of house.*

Fig. 125.



In these examples we have confined ourselves to cottages of one story; we now proceed, in like manner, to consider the arrangement of two-storied structures. In fig. 126 we give a simple arrangement, the bed-room floor of which is identical with the ground, with the exception of the projection containing the porch, &c. The living-room *B* is lighted by two windows, the fireplace being at the end. *A* is

Fig. 126.



* In a future Number we propose giving examples of elevations adapted to the various arrangements we have given.

the porch, giving shelter to the entrance door to living-room *B*; *f* is a water-closet entering from back of porch. Access is gained to bed-room above *B*, the sitting-room, by stairs *E*, entered from living-room by the door *d*. A door at the other side of fireplace gives admittance to a small closet *o*, beneath head of stairs, in which a small slop-stone is placed. For a married couple without family, or a gamekeeper, we consider this arrangement may possess many advantages. By running up the walls of porch, &c., a small chamber entering from bed-room may be obtained, of size sufficient to hold a child's bed. In fig. 127 we have detailed an arrangement by which more accommodation is obtained at the outlay of very little more material, and by which access is gained to the bed-room without passing through the living-room. Entrance is gained to the porch *c*, containing slop-stone *b*, by the external door *a*; *d* is the entrance to living-room *B*; *G* a small closet entering from living-room, placed beneath head of stairs. A water-closet is obtained at *f*; and, by continuing wall to meet back wall of house, a space for coals may be obtained at *l*, a partition being made between it and the water-closet. In fig. 128 we give sketch of bed-room plan of same cottage. *H* is the bed-room above the living-room *B*, with fireplace *c*. A small bed-room *l* is obtained by boarding over part of the staircase, leaving room to go easily under it in ascending or descending the stairs. This small bed-room is lighted by a window *d*, entered from the landing *b*; *a* is the entrance to the

Fig. 127.

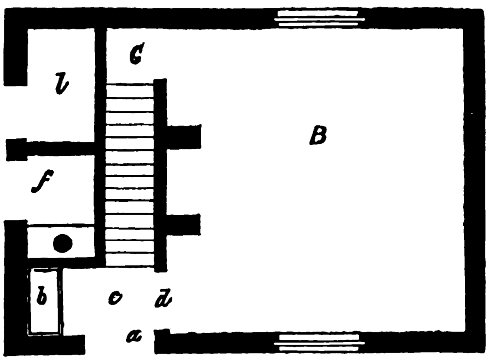


Fig. 128.

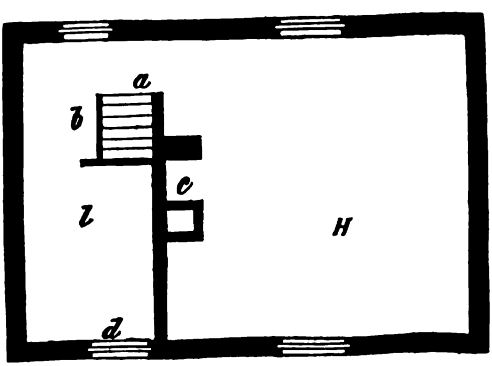
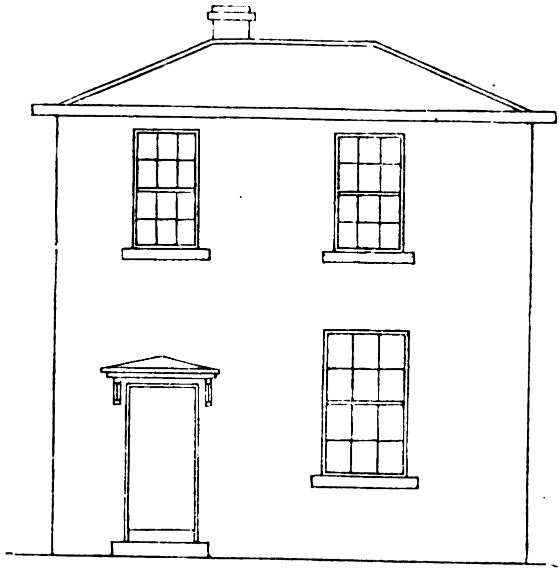
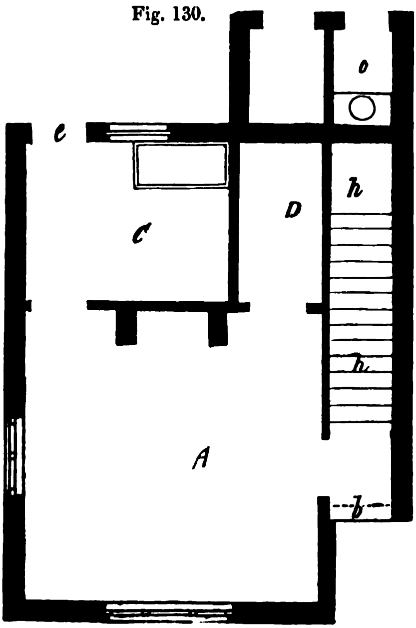


Fig. 129.



front bed-room *H*. The landing-place *b* is lighted by a small window. In fig. 129 we give a sketch illustrative of a suggestion for front elevation for this cottage. It is adapted to be built in pairs, the wall opposite fireplace in living-room *B* (fig. 127) being division wall between the cottages.

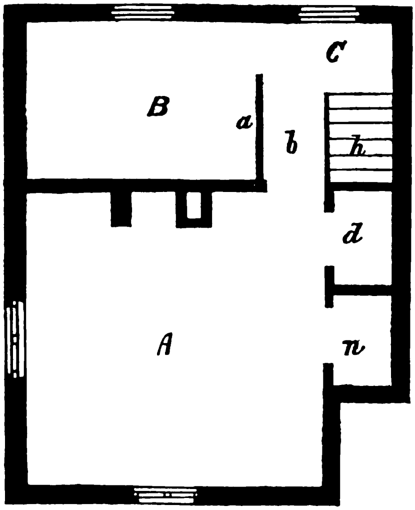
Fig. 130.



In fig. 130 we give the ground-plan of a two-storied cottage, adapted to be built in pairs, of a still better class than last given. The entrance is at *b*, the stairs *h h* leading to the bed-room floor. *A* is the living-room, *C* a scullery provided with slop-stone; if necessary, a boiler may be fitted up in corner nearest fireplace of living-room. Entrance is gained to back yard by the door *e*. *D* is a larder or store-closet entering from living-

room *A*; if necessary, it may be continued under head of stairs at *h*. The water-closet is at *o*, a receptacle for coals being next it. In fig. 131 the bed-room plan of this arrangement is given. *A* is the front bed-room, with two linen-closets or wardrobes, *n* and *d*, entering from it. *B* is back bed-room above the scullery *C;* a partition *a* separates it from the landing *b;* the landing is lighted by window at *C*. If necessary, a children's bed-room can be added, by running up the walls of water-closet, &c., entering it by a door placed at the window *C;* the landing may be lighted by a small skylight above. All the sketches are drawn on a scale of 1-8th inch = 1 foot.

Fig. 131.



And here, before concluding, we would urge upon those about to build cottages in rural or suburban districts, to avoid in all cases the absurdity of there carrying out *town* arrangements. There is some allowance to be made—in the highness of ground-rents and feu-duties—for crowding ranges closely together in towns and cities, and erecting them in all the wretched variety of " back to back," " cul de sacs," and " narrow courts and alleys;" but for the perpetration of this system amid green fields and purer air, there can and should be no palliation or excuse. It is a folly which should be unhesitatingly condemned. In moving from amidst the scenes of " turbid air and chaos of eternal smoke," to a more enlivening and healthy atmosphere, it is surely desirous to have the structural arrangements in unison with the change, and not to be subjected to the cramped and unhealthy closeness of the city street or court; and yet how frequently is this view of the matter lost sight of, if we are to judge by the frequency with which examples of the worst form of city arrangement are to be met with in really healthy, rural, or suburban districts. We can take the map of the environs of one of the largest cities in the kingdom, and dot out whole districts where these can be met with, in profuse variety. But lately we noticed the following barbarism in cottage arrangement: A row of cottages—in all of which, by the way, the living-rooms entered at once from the road—looked out upon as lovely a country scene as need greet the eye of labour-

ing man; *behind* this a second row was built, the front windows of which enjoyed the near prospect of the back-yards of the row to the front; and in order to have the decent requirements of a well-arranged house in perfect keeping with the high standard of arrangement here described, a row of six or eight privies, *without doors*, so far as we could see, were placed at one end of the kind of court formed behind the rows of cottages; and these affording, by their commanding position, a testimony to the standard of morality of landlord and tenant, altogether unmistakable. According to our estimate, one privy served to accommodate three families. Now, for such a case as this, deplorable enough in a crowded town, how can an excuse be offered? Verily, the conclusion we are forced to arrive at is by no means complimentary either to the reasoning powers or notions of morality of builder or owner. We could, did space permit, still further detail, from our note-book of observation, equally glaring instances of how much, even in more favoured quarters, where better things are looked for, the principles of comfort and decency in house arrangement are overlooked; but the question is so self-evident that further comment is unnecessary.

We are desirous that our suggestions should be considered as calculated to serve as the basis upon which good rules may be founded, rather than as the rules themselves axiomatic in their character, and strictly to be attended to before results can be obtained—that our remarks should take the place of a guide who here and there may point out some useful feature, rather than as an authority to whose dicta it is desirous to give implicit obedience. We by no means wish to usurp the place of the professional architect, agricultural engineer, or builder; on the contrary, we are assured, that efficiency in arrangement and soundness in construction, can only be satisfactorily obtained by securing the services of such competent individuals. On the other hand, however, we deem it of essential importance that landlords about to erect new, or alter existing structures, should have a clear perception of the requisites desiderated in well-arranged houses. To assist them in this, our essay may be of some value. Still further to render it useful to a large body of our readers, we have thought it necessary, in addition to our plans, to give specifications, and a few suggestions of exterior elevations: for the more elaborate of these, we are glad here to acknowledge our obligations to a talented assistant.

The question of the amelioration of the condition of the working classes is one, we think, of such vital importance, that we cannot conclude without still further urging its consideration upon those of wealth and influence into whose hands this paper may find its way. It is one which closely concerns us all—no less the wealthy and middle classes, than those who are subjected to the degrading in-

fluences which we are so desirous to see removed from amongst us. Possibly there may be no exaggeration in the statement, that it more concerns the former than the latter. Below the now seeming quiet surface there is a restless mass, which will exercise upon our national constitution a mighty power for good or evil;—for good, if led in the right direction; for evil, if tampered with, or, what is worse, given over to a continuous and heartless neglect. In this way the question will sooner or later demand attention; the period is fast approaching—if the signs of the times are by wise men read aright—when it will no longer be possible to evade its solution or deny the existence of the danger. It may or may not be true, that the base of society is decaying amidst a seething mass of corruption; but it surely is only what good policy or expediency would dictate, that it is wiser to see that the base—for the very reason that it *is* the base—is sound and efficient, rather than allow the ruining influence to remain unremoved, and endanger the whole superstructure.

But if the dictates of our religion and the impulses of our benevolence are forgotten or repressed, and the question of expediency or policy ignored, the time will come when that of right will demand attention. It will be our wisdom, as a nation, not to allow this question of right to be raised in the way it assuredly will, should remedial measures remain much longer in abeyance. Unremedied, the condition of the lower classes is fraught with much danger to the wellbeing of our social constitution; and this danger is not the less decided because so many deny its existence. "Why, let me ask," writes an eloquent author,* "should persons be allowed to erect human habitations in situations and in construction so palpably at variance with every principle of health or convenience? What *right* has any man to crowd human beings, poor though they be, into a space utterly incompatible with wholesome, not to say comfortable, existence? Upon what ground does any one presume to confine this less fortunate portion of his species within limits infinitely too small and obviously insufficient for the maintenance of the healthy functions of vitality? What avail public generosity and private benevolence, our hospitals and dispensaries, if their funds are to be expended and their wards are to be peopled with the inmates of these dens and hovels of infection? It is sacrificing the charity of the many to the cupidity and recklessness of the few; it is catering for the victims of a sordid and unprincipled speculation. If prevention be better than cure, precautionary means wiser than remedial arrangements, the counteraction of existing and immediate mischief more judicious than its subsequent and tardy correction, then it is the duty, as we doubt not it will be the wisdom, of the Legislature to

* Dr Kay, in *Second Report of Health of Towns Commission.*

enact laws, and rectify, so far as may be, the abuses of the past." Well would it be for society were these considerations to be more generally remembered, and the results which reason indicates efficiently and universally adopted.

We may be charged with over-enthusiasm in the matter, nevertheless we are fully prepared to join with those who—calmly reviewing our social and political economy in their broadest bearing—see in this question the all-important one of the age. The task—rightly viewing it, we should rather say the privilege—of amelioration, is one in which the benevolent mind can find its fullest scope, its most ennobling labour; and not less fitted is it as a field in which the Christian can play his important part, and find an able coadjutor. It is the lever by which we can raise the now grovelling and all-lost masses to higher pursuits and more exalted aim.

But this, the initiatory lesson in true progress, we have yet *nationally* to learn, before we can take a high place in the rank of Christian civilisation.

ON THE PRESENT AND FUTURE PRODUCE OF GOLD AND SILVER, AND THE PROBABLE EFFECT OF THEIR INCREASE ON PRICES.

There is no class of the community more interested in the question of prices, as the same may be affected by the present great increase of the precious metals, than the landlords and tenant farmers of Scotland, where leases of considerable duration are universal—as any great mistake as to the average of future prices during the currency of a lease must lead to disastrous consequences to one or other of the parties;—to the landlord if prices, and consequently the expense of living, greatly increase; to the tenant, if prices materially fall. A merchant who imports goods, or a trader who lays in a stock, generally sells them within the year, and is comparatively little interested in a prospective change of prices; but parties who enter into contracts to endure for a number of years are interested in a peculiar degree.

Before entering on the discussion of the probable rise of prices, we shall give a few historical notices of gold, and offer some general considerations.

All experience goes to establish that a large and profitable output of gold from any locality will not continue permanently. It seems to be a law of gold-mining that it gradually diminishes, and then ceases to be worked. Such has been the case from the earliest periods; and such, we believe, will be the same in future. The quantity of gold accumulated by the Jewish and other nations of antiquity, as we gather from the Bible and ancient authors, appears to have been very large. It may be interesting to bring under view a few of the notices of gold in the Old Testament. The earliest is found in Genesis, chap. ii., verses 10, 11, 12—"And a

river went out of Eden to water the garden, and from thence it was parted and became into four heads. And the name of the first is Pison, which compasseth the whole land of Havilah, where there is gold; and the gold of that land is good." This notice of the gold of Havilah shows how very early gold was esteemed as of great value. In the time of King David, it appears that large quantities of gold had been amassed with the view of building the Temple. It is recorded in 1 Chronicles, xxii. 14, as follows: "I have prepared for the house of the Lord a hundred thousand talents of gold, and a thousand thousand talents of silver." These sums are respectively, in our money, about £19,300,000 and £193,000,000. These immense sums, we must presume, Solomon expended on the Temple agreeably to his father's desire. Notwithstanding of this, it would appear that Solomon had great treasures of gold remaining. It is stated in 2 Chronicles, ix. 13, that "the weight of gold that came to Solomon in one year was six hundred and sixty-six talents, besides that which chapmen and merchants brought." The sum mentioned is equal to £128,538, and was exclusive of what was contributed by "all the kings of Arabia, and governors of the country." The Queen of Sheba alone is said to have contributed a hundred talents of gold. The chapmen and merchants, it may fairly be presumed, would also bring large sums. Turning to the Roman Empire, we find still larger sums spoken of. Vespasian, at his accession, said that to support the commonwealth there was need of £323,000,000;* and Jacob estimates the treasure of the Empire, at an early period, to have been equal to £350,000,000, which, towards the close of the Empire, was reduced to one-tenth of that amount. Other nations, at the same time, possessed considerable quantities of the precious metals; and when we consider that no part of this was drawn from the gold and silver fields of America—now yielding so large a prcportion of the whole produce of the world—the amount possessed by the ancients is truly astonishing. But the sources from which such a mass was accumulated are now nearly dried up; and it is estimated that the Old World does not now produce annually more than about six millions sterling, while the New World produces about twenty millions. This consideration must tend to moderate the fears of those who dread a very rapid accumulation of gold. We may with confidence look forward to the time when the present most productive mines will be abandoned in their turn. There are many other modifying circumstances, as we shall see by and by.

When the gold deposits in California were discovered in 1848, many loose speculations were hazarded as to the probable effects on prices—some maintaining that, in a few years, prices generally

* Adam's Roman Antiquities.

would be greatly increased, and that of silver in particular. In other words, that the value of gold would fall so much, that a given quantity of it would purchase a much smaller quantity of anything else. Acting on this notion, Holland took the lead, and rid herself of her gold coinage, and confined herself to silver, which she must be already satisfied was a great practical mistake, the value of silver being no higher at the present time than it was before the commencement of the Californian gold-diggings. Such notions were moderating in 1851, when the gold fields of Australia were discovered, which has again set them afloat; and as the facts of the case have now accumulated to a considerable extent, we are in a position to consider the leading questions that present themselves on the subject, with some hope of arriving at an approximation to a true result.

In trying to estimate the effect on prices likely to be produced by the present great increase in the produce of the precious metals, and chiefly of gold, it seems important to keep in mind that they must be viewed simply as mercantile commodities, and that their value is regulated by the usual laws that affect prices. The value of gold and silver, even when manufactured into money, or coined, depends essentially on the same laws as other manufactures. Their price will mainly depend on the cost of production, and the relative supply and demand. The price will fall from a reduction in the cost of production, and from the supply being greater than the demand. There can be no doubt that the cost of the production of gold in California and Australia is at present considerably less than it was in the older mines; and as the new and more easily worked sources now supply the greater portion of the annual produce, a fall in price might at first sight have been expected to have already occurred—and at the mines it has occurred; but it has not yet extended to Europe, as the increased demand has hitherto been about equal to the increased supply. Some of the causes that have prevented a fall are obvious. Simultaneously with the commencement of the working of the new mines occurred a general revolutionary movement in Europe; a consequent hoarding of the then existing specie; a great demand for gold and silver to pay the military and naval forces; a change from a silver to a gold coinage in France, which absorbed, in one year, twelve millions of pounds sterling; and the substitution of gold for small notes in America, and an extensive coinage to meet the wants both of the new and older states. All these causes combined afford a sufficient explanation why there has been no perceptible effect on prices hitherto in Europe; but these being temporary causes, and the demand occasioned by them being now in a great measure supplied, the natural effect of a continued increased supply may be looked for.

So long as there is an effective demand for all the gold annually

collected, the price may be kept up at its present rate, notwithstanding the reduced cost of production in the newly discovered mines, as the price will be regulated by the cost of production in the inferior mines, and the superior mines will, in the mean time, clear larger profits; but so soon as there is not an effective demand for the whole annual produce at the old price, then the price will fall, as the holders will not allow their gold to accumulate indefinitely, but will sell it at the best price they can get. That a fall to some extent is approaching, seems to be indicated by the large deposits of bullion accumulating in the Bank of England and in the Bank of France; and looking to the probability of a still further increase of the supplies, a fall to some extent seems inevitable at no distant date; in other words, a relative increase on the price of land, stocks, merchandise, &c.; for it is against all experience and mercantile principle to suppose that the accumulation of unemployed gold will be allowed to go on; and the only way to increase the demand, and take off the accumulating supplies, is a reduction of price. And that an effective demand will be created, to any extent required, by a reduction of price, admits of no doubt. It is an inflexible rule that, so long as a profit remains, sales will be made; and if a commodity will not bring the price demanded, a lower must be submitted to, in order to effect sales and take off the accumulated stock. Capital is never allowed to lie long idle, small profits being better than none; and gold will form no exception to the general rule, and will be sold for what it will fetch, down to the point of no profit rather than allow it to accumulate for a length of time.

Let us now consider the probable supply and demand of the precious metals for the future. The average produce of Europe and America for many years prior to the recent discoveries in California and Australia—and the supply from other quarters was of trifling amount—is estimated at about £10,000,000. It is now (1852) estimated at £24,000,000. The present annual addition to the former supplies of the precious metals may therefore be stated at £14,000,000. This is a large addition to our annual supplies, no doubt; and as, after the discovery of the American mines in the fifteenth century, a very great rise of prices took place, we are apt to jump to the conclusion that a similar result will occur now. But the circumstances are totally different, and we have no idea that anything like so great a change as occurred in the sixteenth century again awaits us. Let us see, in the first place, what that change was, and what were the circumstances in which it occurred; and, in the second place, let us consider the different circumstances that now exist. The American mines were discovered in 1492; and, according to Humboldt, who is a very high authority, the annual produce up to 1500 was only 250,000 dollars.* At this

* HUMBOLDT, *La Nouvelle Espagne.*

time the price of wheat in England was about 10s. a quarter. From 1500 to 1545, in which latter year the valuable silver mines of Potosi were discovered, Humboldt estimates the annual produce of America at 3,000,000 of dollars. Notwithstanding this considerable increase of gold and silver, extending over 45 years, the price of wheat continued nearly the same, the average rise being only 1s. a quarter. From 1545 the supplies of the precious metals rose rapidly, and up to 1600 the annual produce is estimated at 11,000,000 of dollars; yet, it was only after 1570, being seventy-eight years after the discovery of the American mines, that the price of wheat rose considerably. This is an important fact, which, we apprehend, is not generally attended to. We believe the popular notion is, that the rise of prices followed much more immediately on the discovery of the mines. After 1570 the price of wheat rose rapidly, and from 1595 to 1620 its average price was £1, 12s. 8d. From 1600 to 1700 the annual produce of the mines was sixteen millions of dollars. In 1636 the average price of wheat was 40s., and the best 50s. From this time to 1700 the price fluctuated very much, owing to the civil wars and bad harvests, but the average price was about 50s. It was as high as 85s. during these wars, and fell as low as 28s. after the Settlement in 1688. For our purpose we shall build no argument on such unsettled times, and we hold the effect of the American mines in raising prices as nearly completed so early as 1640. The mines, subsequent to this, continued to pour forth their wealth in a continued stream of steady and gradually increasing flow, till they reached a produce of about nine millions of pounds sterling in 1800. But this supply was not greater than the demand: the growing wants of the community absorbed it as fast as it was produced. From that period till the discovery of the Californian mines in 1847, the produce considerably diminished, but the deficiency was partly met by increased supplies from Russia. We are quite aware that, for a considerable period towards the end of the last century and the beginning of the present, the price of wheat was higher than 50s.; but this increase arose from other causes than the increase of the precious metals—namely, from the artificial state of this country, created by the suspension of cash payments by the bank, the corn laws, and the protracted war. In the first half of last century the price was considerably less than 50s., and at present it is as low as it was two centuries ago, notwithstanding the immense additions that have been made to the stock of the precious metals during that period. We do not say that prices were not sustained by the annual additions of bullion after 1640, nor that they would not have fallen had these additions ceased; but our position is, that the increasing population and transactions of the world increased the demand for the precious metals so as fully to absorb the additions to the stock of

them, and prevent their occasioning a further rise in prices. The problem to be solved is, Whether this will continue to be the case, now that the supplies are so greatly increased? We fear that data for the accurate solution of the question cannot be obtained, but we may arrive at an approximation to a true result from such materials as we have. We may, we think, assume as a fact, that the effect of any addition to the precious metals will be somewhat in proportion to the accumulated stock of them, and to the population and transactions of the world at the time. If, then, we had a correct account of the stock of the precious metals, and of the population and transactions of the world in the sixteenth century, when prices were seriously affected, as well as of the additions then making to the stock of the precious metals, and had similar information on these points in reference to the present time, we might form a tolerably correct opinion of whether the influence on prices now, from the additions making to the stock of the precious metals, was at all likely to be similar to what occurred in the sixteenth and seventeenth centuries. Such an estimate would require considerable qualification, however, for the greater increase in transactions than in population that takes place as civilisation and wealth increase. For this, allowance would require to be made. Let us see whether we can make an approximate estimate from the materials we possess. We have no statement of the supposed amount of the stock of the precious metals at the time of the discovery of the American mines; but looking to the immense additions that have been made to it for three centuries and a half, and that the present stock is only estimated at one thousand millions sterling, we may conclude that the stock was then very small, and additions to it would, in consequence, more easily act upon it and produce changes. At present, the stock being so very much larger, it will be all the more difficult to act upon. The population of the globe in 1550 is estimated at 108,000,000. At present it is estimated at 970,000,000, and is rapidly increasing. In some of the newer countries it doubles in twenty-five years. In Great Britain it doubled between 1801 and 1851, a period of fifty years.

As it was only the new sources of supply of the precious metals that affected prices in the sixteenth and seventeenth centuries, and as it is the new sources of supply alone that are expected to affect prices now, we may, for the present, throw out of view the supply from the older sources. The addition to the precious metals, from new sources, from 1550 to 1650, which embraces the whole period of the great rise in prices, was thirteen millions of dollars annually, on an average, which, at 4s. 2d. a dollar, gives an annual addition of £2,708,000. The average annual increase of population, during the same period, is estimated at 1,080,000; so that the addition made to the precious metals, for each additional person, was twelve

dollars and a fraction, or about £2, 10s. The present annual addition to the stock of gold and silver of the whole world, from new sources, is estimated at fourteen millions sterling, while the increase of population is estimated at fifteen millions; so that the new increase of the precious metals is only about 18s. 7d. for each person added to the population, or little more than one-third of the addition that was annually made during the century in which the great rise of prices took place. But the effect of the present addition will be still farther materially diminished if we consider in how much greater a ratio trade and transactions of all kinds have increased than population. If we look at Great Britain, for example, while the population has only doubled in fifty years, her imports and exports, which may be taken as an index of her transactions of all kinds, have increased more than fourfold. In 1800, her imports were, in official value, £30,570,605; her exports, £43,152,020. In 1850, her imports were £100,460,453; her exports, £197,309,878; so that, taking an arithmetical proportion of the precious metals in reference to the trade of the country, we find it would require more than four times as large a quantity to carry on the business of the country in 1850 as it did in 1800. It is well known that Great Britain did not receive, during this period, such immense additions; but the deficiency was, in a great measure, supplied by the liberal use of paper money during the first half of the period, and by the increased use of bills, bank cheques, and other substitutes for money. And it is also well known that, when a restriction was put upon the issue of paper money, and a return made to a metallic basis for our currency, prices were forced down, which is quite in conformity with the views we have stated. The equilibrium between money and transactions was disturbed, by the latter being in excess.

We shall now state the proportion which the new supplies of the precious metals bore, at the two periods of 1550 and 1852, to the total population of the globe. As before stated, the estimated population at the former period was 108 millions, and the estimated new supplies of the precious metals was eleven millions of dollars annually, or a trifle more than one-tenth of a dollar, or 5d. annually for each person. At present, the new supplies are about £14,000,000, while the population is 970 millions, which gives, in round numbers, about 3½d. for each person, or one-fifteenth of a dollar. This is one-third less than was afforded at the former period; but if we consider the increased facility of transport now afforded by steam-ships and railways, and look to the rapid progress of our own country and of America, and some other countries, we may safely assume that the transactions of the world have increased fourfold in proportion to the population; and if so, instead of a diminished proportional supply of the precious metals producing a similar effect to what occurred in the sixteenth and seventeenth

centuries, we are forced to the conclusion that a greatly increased proportional supply would be required to produce such a result.

As the principles of a free trade become better understood, and more extensively acted upon, and a freer exchange of commodities takes place, the supplies of the precious metals will be rapidly diffused over the whole world, and a great impetus given both to production and population, all tending to increase the power to absorb these supplies.

We may then, we think, safely conclude that the present supply, supposing it not to be materially increased, will only affect prices very gradually. But the supplies may possibly be largely increased. So long as the diggings are chiefly in the debris of auriferous rocks and alluvial deposits, as at present, the business of gold-seeking cannot be said to have arrived at its permanent or settled state. This will only occur when mining is carried on in the auriferous rocks themselves. Considering the immense numbers who are now flocking to the diggings, the auriferous debris and alluvial deposits will probably be turned over, and their treasures extracted in a few years; and it is to the rocks we must look for a permanent supply. When the former are exhausted, the expense of extracting the metals will be considerably increased; but as long as it continues profitable, the extent to which it may be carried can scarcely be foreseen. Geology has thrown much light on the proper localities for the search after auriferous rocks and deposits, and shown that they are extensively diffused throughout the globe; and it may be that the time will come when, from the number of hands, and the extent of machinery employed in extracting gold, the supplies will be so largely increased that another revolution in prices will occur; though we confess we have no idea that such a result will occur, if at all, except by slow degrees and in a long period. At the same time, we must allow that there are indications that a rise of prices is approaching. There are, however, powerful counteracting effects that will come into operation to retard such a rise. Some of these we shall now notice. First, we may state, that the immediate effect of any considerable fall in the value of gold would be to stop the working of all the mines in Europe, and all the inferior mines elsewhere, which are now only yielding a small profit. Should the fall in the value of gold be 10s. an ounce, this would happen; for the European mines generally, and the inferior mines of America, do not at present yield a profit of that amount. This would tend to check the downward progress, by so far lessening the supply. In the second place, every addition to the stock of the precious metals diffused over the world, increases the mass to be affected, and lessens the influence of any addition. Suppose the total increase to be £30,000,000 annually. In ten years this would give £300,000,000 additional to be influenced by the annual increase.

This will farther tend to moderate the fall. In the third place, as the principal deposits of gold lately discovered have been found in the debris of auriferous rocks and alluvial deposits, accumulated for ages, it cannot be expected that the working of the mines in the rocks themselves will be equally profitable. This has been confirmed by experience. Many of the older mines in America had been abandoned before the late discovery of gold in California; and already in Russia, and California itself, the supply from several of the mines is diminishing. The diminution of the supply from the Russian mines is about one-fourth since 1847. An engineer of the mines in California, after an extensive tour through them, writes as follows, so lately as the month of April last:—

I send you the result of my experience of the produce of the auriferous rocks here. In each instance the operations were on three tons of quartz, which were reduced to powder, and treated with care by amalgamation. Five experiments were made in the district of Bath, situated between the Yuba and the River Plume, upon as many veins. No. 1 gave 3 dollars 33 cents the ton; No. 2, 9 dollars 30 cents; Nos. 3 and 4, 11 dollars each; and No. 5, 17 dollars. In the district of Novada, experiments were made on four different points. No. 1 gave 15 dollars the ton; No. 2, scarcely any particles of gold; No. 3, 14 dollars the ton. This mine, upon which a company had established machinery, has been abandoned. No. 4 gave 59 dollars a ton; the vein was of extraordinary richness, and yielded the proprietors a considerable profit. In the district of Eldorado, three different veins did not yield more than 17 dollars a ton; a fourth yielded 59 dollars. In the district of Mariposa, of eight experiments, three veins yielded scarcely 3 to 7 dollars the ton; three, from 7 to 20 dollars; one yielded 24 dollars, and another 38: the two last veins had attracted miners, who were preparing to work it.

The notion that any one may work at the diggings, as they are called, without capital and without machinery, will only continue true during the earliest stage of gold-seeking, when the operations are confined to the digging and washing of the auriferous sand and gravel accumulated in certain localities. As soon as it becomes necessary to resort to the auriferous rocks, circumstances are totally changed; skill, capital, and machinery are then required, and the "digger" must work for such wages as the capitalist will allow him, or want. The writer quoted above says:—

No enterprise requires more attentive study or greater expense than the working of auriferous quartz. A good vein, for example, that will give 36 dollars the ton, may be considered by moderate men as satisfactory. Much richer veins are indeed sometimes found; but of all the crushing-mills that have been established in California, I believe there is not a third part employed on mines that yield 30 dollars a ton, during operations of some duration. Accordingly, half of the works of this kind are already stopped.

But, after making due allowance for all these retarding influences, we are decidedly of opinion that we may look for a gradual fall in the value of the precious metals, and a rise of prices. This may not be perceptible from year to year; but if we take quinquennial periods, we should anticipate a decided rise from period to period, probably, for a century to come.

We shall now notice a few of the other questions connected with the new supplies of gold and silver. And first, as to money.

In regard to gold and silver, as money, we need not say much. Substantially the same laws regulate the value of the precious metals, when manufactured into money, as regulate them in the state of bullion. The real value, or cost of production, is the primary law. It is impossible long to maintain a fictitious value to money. Arbitrary laws may for a time, and in a limited sphere, give it a fictitious value, but it cannot long be maintained above its real value. All attempts to give permanent currency to debased money—that is to say, money of less real value than its nominal value—have failed. The pieces will only circulate for what they are worth. The English sovereign, being of established purity and weight, circulates over the whole world, and is coming more and more into general use. Another point, in reference to money, worth notice is that, let the amount of the precious metals be what they may, only a certain demand will exist for coined money; and this demand will not bear any proportion to the quantity of bullion produced, but to the trade which is carried on at the time. As transactions increase, the demand for money increases; and as trade decreases, the money requisite to carry it on decreases, and consequently the demand for it. We can thus perfectly conceive how, with a great accumulation of bullion, the demand for money might decrease. If capital in other shapes, which sets industry in motion, was diminishing, while bullion was increasing, less money would be required.

We shall now proceed to make some remarks on silver. One of the first anticipations from the discovery of gold in California, was that silver would rise in value; and the government of Holland, acting on this idea, parted with its gold coin, and substituted silver. Concurrently with this, the state of the greater part of Europe was such, that silver was in much request, owing to the currency being chiefly silver—and the agitated state of these countries causing both an increased demand for payment of the armies, and a general panic, which produced hoarding to a large extent. The consequence of these combined causes was, that silver became scarce, and did rise for a time from 2 to 3 per cent, giving a semblance of truth for the moment to the speculations of those who maintained that silver would rise with the increase of gold. But as soon as the revolutionary movements of the Continent were put down, silver returned to its usual channels, and the temporary scarcity ceased, and with it the rise in price; and at the present time, although the produce of gold has been going on increasing for four years, the price of silver has not increased. All fear of any rapid change in the relative value of the two metals is now well-nigh extinct; but still many persons believe that silver will gradually rise in value. In this opinion we do not concur, but

rather anticipate a fall in the value of silver; and we shall now state some of the reasons which have led us to this conclusion. In the first place, when we look into the history of the production of gold and silver, we find great changes in their relative amount of production, without any corresponding change in their relative value. It seems to require a great change in their relative production, continued over a long period, to affect their relative value. Since the discovery of the silver mines of Potosi, in 1545, to the present time, no very great change has taken place in the relative value of these metals, although very great fluctuations have taken place in their relative production. Thus, soon after Potosi was worked, the produce of the American mines was as 60 of silver to 1 of gold in weight. In 1700 it continued at about this rate. In 1750 it had fallen to 30 of silver to 1 of gold. In 1803, Humboldt estimates the proportion as 46 to 1. During all these great changes in their relative quantities, there was scarcely any change in their relative values. We conceive we are therefore warranted, from experience, to state, that it requires a long-continued and great change in the relative quantities of the precious metals to change their relative values. During all the time we have been considering, the disproportion between the total quantity of gold and silver in the market of the world was altering from year to year, by a steadily increasing proportion of silver. While we were adding 1 ounce of gold to the mass, we were adding from 30 to 60 ounces of silver. Now, however, since the discoveries of gold in California and Australia, matters are quite changed. The proportions of gold and silver, in weight, produced, are now only as 1 to $3\frac{1}{2}$. This is about the proportion produced directly from the gold and silver mines: but it is material to notice, that all gold is more or less alloyed with silver; and by separating the silver from the gold, a very considerable portion of silver is produced, varying from 1-8th to 1-10th of the whole weight. This will alter the above proportion of gold and silver produced, to 1 of gold to each $3\frac{6}{10}$ of silver. This is, no doubt, a greater revolution in the relative proportions of the metals than we have before experienced; but still there are considerations which will modify very much this first aspect of the case. In the first place, we observe that every increase of gold, as we have just seen, brings an increase of silver. In the second place, silver, it is well known, cannot be worked without quicksilver; and till lately the supply of that article was chiefly brought from the Spanish mines of Almaden, and a monopoly price paid for it, which rendered the working of silver so expensive that many mines were shut up. Lately, however, quicksilver has been discovered in California, and in different localities in South America, and already it has fallen 15 per cent in price. The effect of this will no doubt be, to give an impetus to the production of silver, which will raise the relative production of it.

We have thus two causes of an increased supply of silver. But, besides these considerations, we maintain, in the third place, that the present great efflux of gold tends to diminish the value of silver, by superseding its use. Already we have seen France adopt a gold instead of a silver currency, and in one year (1850) coin as much as ten millions of pounds sterling of gold. Other countries that have hitherto chiefly used silver coin or paper, will no doubt follow—as gold, being so much less bulky than silver, is of comparatively easy transport; and, being less liable to be counterfeited, and less subject to abrasion, is much more suitable for coin. America, for the last two years, has coined large quantities, and has introduced gold coins of various denominations, varying from £4 to 4s. At the time we write, there is a scarcity of silver coin in England, arising from temporary causes—chiefly the late demand for paying harvest wages, the export to Australia by emigrants, and also on merchants' account, to meet the growing demand for coin there, occasioned by the increased business of the colony; and we should not be surprised to see our Mint coining quarter sovereigns, as a substitute for silver coin, to a certain extent. We may also anticipate that, as wealth and luxury increase, silver will be less used in the arts, and be supplanted by gold; for, although we can hardly look forward to a time when, like Solomon, "our helmets and our shields" shall be of solid gold, yet we may well imagine that our "drinking vessels and our spoons" will, like his, be of pure gold, instead of silver. In the fourth place, the value of silver, like that of gold, must mainly depend upon its cost of production, and we have already indicated how this will be diminished. In working for gold, a great part of the expense of the silver got from the gold, which we have averaged at one-tenth in weight, will be borne by the more precious metal. This, and the increase of quicksilver, will cheapen the production and lower the price. And if, as we believe, the demand for silver shall diminish, we should rather expect a fall in its value than a rise. Lastly, we deny, on more general grounds, the truth of the assumption on which the expected rise in the value of silver is based, viz., that when two articles are used for similar purposes, if the one increases in quantity, while the other does not, the latter will rise in price. This, we apprehend, is quite a mistake. As long as the price of other commodities is not raised by the efflux of gold, there is no reason why the price of silver should rise. If all commodities were to be raised in price, silver would be raised along with the rest, but no sooner. As yet, no such general rise has taken place, and therefore none has occurred in silver. To illustrate this further. Suppose there was a sudden great increase of cattle, without an increase of sheep, would it be rational to maintain that the value of sheep would be thereby raised? We apprehend not. Our belief is, that the value of both cattle and sheep would fall.

Or, suppose a sudden great increase of wheat, while the quantity of oats was stationary, would oats rise in value? We apprehend not. Both wheat and oats would fall. So it is with the precious metals. Increase the supply of both, and the tendency will be downwards; increase the supply of one, and the tendency will be the same.

There is another collateral question which we may briefly notice,—viz. the obligation imposed on the Bank of England to give £3, 17s. 9d. an ounce for gold. It has been supposed that this obligation might come to operate very injuriously if the price of gold were to fall; but this is a mistake. The obligation amounts to nothing more than this, that the Bank must give bank-notes to the amount of £3, 17s. 9d. for an ounce of gold; which bank-notes they are bound to pay on demand, in coined money, at the rate of £3, 17s. 10½d. an ounce, thereby returning 1½d. an ounce less than they received. As long as gold and bank-notes are convertible into each other at pleasure, at the above rate, neither can be at a discount—neither can be at a premium. Nor would the matter be at all changed though the price of gold were to fall to £2, or any other sum per ounce. The Bank would still give notes to the same nominal amount as formerly for an ounce; but when payment of the notes was demanded, it would only return an ounce of gold, value £2, or whatever the price was. In short, whatever the price of gold may be, it matters not to the Bank. It will receive a given weight in exchange for a certain amount of paper money, and it will pay the same amount of paper money on demand, with the same weight of gold it received. It is a mere exchange of a piece of gold for a piece of paper, promising to return the same piece of gold, or one of equal weight and fineness, on demand. The standard of value, as it is called, has no bearing on this question. Its real bearing is on an exchange of silver for gold, and *vice versa*. It is between these two metals that the standard has been erected, which is the fixing an arbitrary relative value, viz. 20s. of silver against a sovereign, or a certain weight of the one against a certain weight of the other. If the relative value in the market were to come to differ materially from that fixed by Government, the standard could not be long maintained. The real value in the market would break down the arbitrary standard, and a new standard would require to be adopted. But as gold is the only legal tender for payments above 40s. in the United Kingdom, no great inconvenience would arise although the relative value of the two metals were to change to some extent. We have already explained our reasons for thinking that no great change will occur.

J. R. S.

EMIGRATION: THE LAND QUESTION IN IRELAND.*

In the number of this Journal for January 1852 we stated our opinion that the time had arrived which was admirably suited for the settlement of the land question in Ireland. Various circumstances, however, occurred during the last Parliament to retard the legislative measures which we know had been in preparation. New elements have since entered into the consideration of the subject, the tendency of which it is not easy *a priori* to determine, but the importance of which cannot be exaggerated. We allude particularly to the enormous impetus given to emigration by the discovery of the gold regions in Australia, and to the perceptible difference in the class of emigrants. The effect of the discovery is discernible throughout the United Kingdom, but has an especial bearing on the condition of Ireland.

At the recent meeting of the British Association in Belfast, Mr Locke read an extremely valuable paper on excessive emigration, and its reparative agencies, in Ireland. He is the reputed author of the pamphlet entitled "Ireland, &c.," cited below, and a gentleman who has had peculiar facilities in investigating the proceedings of the Encumbered Estates Court, from a combination of agreeable and disagreeable associations. He informs us that his own property was sold through the medium of the Court; and he has been more beneficially connected with it since, as one of the staff of the Commissioners.

"The prosperity of Ireland," one of the Charter toasts of that country, has long been anxiously sought, but hitherto undiscovered, by statesmen or philanthropists. No sooner does a change decidedly for the better appear in the moral atmosphere, than there supervenes, with a suddenness as fitful as the climate, a relapse into crime and outrage so intense as to dishearten her most sanguine and earnest well-wishers.

It is not, however, altogether accurate to compare the moral with the physical condition of Ireland, though there be many striking points of analogy. One striking distinction prevails, that, whilst the climate is variable, alternate sunshine and shower, the moral atmosphere seems, of late years, to be so impregnated with disease, as to be steadily *chronic* in its bad characteristics.

An old English writer on that island called her "our inconstant sea-symph sister;" and a modern speaker, with as much elegance, though not so much propriety, "The Niobe of Nations."

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* Ireland: Observations on the People, the Land, and the Law, in 1851. Dublin: Hodges & Smith.

Excessive Emigration, and its Reparative Agencies in Ireland: a Paper readby Mr Locke before the British Association in Belfast, on the 4th September 1852.

Sorrows she has experienced, but adversity has not had its sweet uses. The precious jewel has not shone forth gemmed with the ornaments of internal peace and good-will; and the results are manifest, that Ireland alone, of all the portions of the British empire, is retrograding amidst the general advance of the world. In England, the iron and golden ages appear on the point of blending harmoniously, and the utmost commercial prosperity goes hand in hand with the most perfect internal repose and tranquillity. In Ireland, commercial enterprise is checked by crime, and her public men meet, not to foster industry and develop industrial resources, but to agitate questions too well calculated to renew the bitterest contests of sectarian animosity. Meanwhile the blood and bone and sinew of the people are flying from it—"the outflow is of vigorous adults, by whom population is mainly sustained, whilst orphaned infancy, destitution, and old age, an unprolific remnant, are left behind."

In 1851 the extent of emigration was estimated at 257,372, or double the average of the preceding ten years,—and in the year which has just gone by, it was much greater; and we believe that the emigrants are of a better description, from a cause to which we shall advert. In our earlier years, when the state of Ireland was, as it is now, a subject of our anxious contemplation, her evils were very generally attributed to a redundancy of population—and that population fed on the potato, the lowest kind of food for the sustenance of European man. These causes exist no longer; and then comes the inquiry—Will Ireland in consequence be thereby benefited? Mr Locke computes, if the present rate of emigration go on, that that country will, in a very few years, be denuded of its agricultural population; and that disease, which fell with such blighting influence on the potato in 1845-46, still lingers with more or less of severity, and threatens the extinction of that esculent as a staple of food. Every imaginable specific has been tested by the scientific and the practical alike,—lime in every form, composts of every character, peat, soot, ashes, soil of every quality, the most ingenious and the most whimsical experiments, have been tried successively, and as often failed. It would be amusing to compute the number and variety of these experiments, demonstrative alike of the zeal of the experimentalists and the difficulty of the object pursued. Whole tubers—tubers with single, double, triple, quadruple eyes—eyes down, eyes up, eyes oblique, eyes horizontal, have been all consigned to mother-earth, with the same adverse fate: they have been planted healthy, and dug diseased.*

* Indeed, one specific, as it is one of the most recent and original, deserves a more distinct notice. The *Gardeners' Chronicle and Agricultural Gazette*, of the 25th September, contains a notice of a report published from the *Comptes Rendus* by a French gentleman, named Bayard, (possibly a descendant of the illustrious Chevalier of the same name,) who stuck one, two, or three dry peas into some potato sets, which grew

To return to the subject of emigration: There is one part highly creditable to the Irish emigrant, and in which he will bear a favourable comparison with his British brother; it is this,—that no sooner has he made himself independent, than he remembers his relatives at home, and remits to them his earnings, that he may gather round him the old familiar faces. The remittances to Ireland in 1851 amounted to the vast sum of £990,000.

Ties of country were torn asunder; but it is gratifying to record that those of kindred were not dissevered, and that the voice of nature beat as strongly in the Irish exile's heart in the forests of America as in the glens of his own land; and let it be remembered, too, that the class of emigrants to North America were generally the lowest in the social scale—labourers, farm-servants, and dispossessed squatters.

There are points of character and traits of humour, despite their manifest faults, which make Ireland and the Irish most interesting, though he who loves them must possess an affection of that enduring character that prompts him to utter, with the Scottish poet—

I love thee better still,
Even in extremity of ill.

It will be observable that, down to the present year, the flow of emigration, though large, was not of a character to create alarm. The emigrating population were chiefly of the class to which we have adverted; and it was anticipated that no more would be withdrawn than was necessary for the consolidation of farms, and the agricultural improvement of the country by a redistribution of lands into large divisions.

With the diminution of the rural population the trade of the country shopkeepers declined and died away. We have not, therefore, been surprised to learn that many of that class have emigrated within the last year. The discovery of gold in South Australia has given an impulse to emigration, traceable not alone

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strong and flourished, and were without disease; while other sets, which had no peas inserted in them, produced plants which decayed. M. Bayard attributes the good effects of his remedy to the absorption of the excessive humidity of the tuber by the germinating pea. Though the use of the pea in this way is new, we think that the idea itself has been suggested to M. Bayard by a passage in the life of Gil Blas. We allude to that in which this very acute person made the discovery that Dame Jacinta preserved the soundness of her constitution and the freshness of her complexion, by putting an issue into each leg. The principle in each case is the same, and so also is the *modus operandi:* the bad humours of the potato tuber and of the animal body are drawn forth through the agency of an issue pea. The analogy, however, ceases in this particular, viz., that the pea does not become reproductive when imbedded in flesh, whereas in the case of the potato it germinates, grows to maturity, and yields a healthy progeny of peas, even should it fail in correcting the morbific tendencies of the pulp in which it is inserted. Not being sanguine of the success of the French discovery, and of the regeneration of Ireland through the renewed vitality of her vigour-stirring root, we must look to other means.

to the alluring qualities of the metal, but likewise to the place of its discovery. Many loyal subjects of the Crown were reluctant to become subjects of the American republic; and the Canadian provinces, which did not progress in the same ratio as their "go-ahead" neighbours, did not possess sufficient inducements for settling in them.

Now, the case of Australia is irresistible. A British queen governs it—British laws maintain liberty, and protection to property—whilst gold is among the productions of the earth, in the finest climate in the world. It is not, therefore, surprising that the class of emigrants has both increased and improved. The exodus—to use the phrase of the day—began with the peasant, passed to the farmer and shopkeeper, and has now reached the gentry and the professional ranks. Activity prevails in Ireland, but it is activity to leave her shores; and it is not a little surprising that the merchant-class there has not been more prompt to avail itself of whatever advantage may be gained by this step. Scarcely a good emigrant Australian ship has sailed from Ireland, and the gentleman emigrant has almost invariably to depart from Glasgow, Liverpool, or London. Have any of our readers ever seen emigrants leaving Ireland for North America? If not, though it may be an instructive, it is assuredly one of the most painful scenes it has been our lot to witness—the wildness and bitterness of lamentation that bow down the departing and the friends left behind, are indicative of an intensity of affectionate feeling. And amongst the lowest classes, their want of any comfort, due preparation for the voyage, and their ignorance even of the point of destination, render the contemplation of the poor emigrants' separation from the kindred home and country painful in the extreme, and scarcely relieved by the more than probability that they are going forth to obtain comfort and independence.

With respect to emigration to Australia, the case is different. The voyage is longer, and requires, from the individuals undertaking it, more enterprise and capital; and, consequently, those only who have some energy and pecuniary means go there.

We have been both pleased and pained at the foresight, determination, and skill which some of the higher description of intending colonists have manifested. Habits of recklessness seemed, by the touch of a magician, to have given way to those of forethought. The interrogatory was—what is best to take out, and how best to prepare for the new scene of employment?

In one instance, at least, we could not forbear thinking that if half the amount of energy displayed in preparing for emigration had been perseveringly exercised at home, exilement would have been needless.

Such are the facts of emigration. Are they to work for good or for ill?

In his pamphlet, at page 51, Mr Locke has the following eloquent remarks:—"Amid the tumult and confusion of hundreds of thousands hurrying seaward, one feels distracted, and almost incapable of reasoning calmly upon this national exodus. Yet we would draw cheerful conclusions from the event, which will have the double effect of raising the wages of the labourer and emptying the workhouses at home; while the generous temperament of the emigrant Irish, shrouded here by national misfortune, unfolds beneath more genial skies, and the spirit that despair and apathy had wellnigh extinguished, bursts into life and light when brought in contact with the irrepressible energy of the American. . . . . Those who fear the effects of a deficiency in the labour market, forget the wonderful progress, even within the last few months, of scientific substitutes for human labour. The steam-plough and the reaping-machine will fill the blank left by emigration from England and Scotland — and it may be, from Ireland also. We would fling open wide, and wider still, the gates of transit to our colonies, and prescribe no arbitrary limit to the exode to stranger lands, which must receive, together with our people, the moral influences of our national character and distinctive civilisation. Empires of old time planted their colonists in warrior lands, to destroy and separate and enslave. Now the system is reversed. Patriotism is a selfish principle no longer; and every colonising emigrant is an additional link in the affiliation of the peoples of the earth. We fear not the consequences to the United Kingdom of emigration; for we believe that the embassage of universal civilisation is stamped upon the destinies of that unrivalled empire, whose children, even now, are grouped on the shores of all oceans which her commerce cleaves."

It is observable that in England, contemporaneously with the great outpouring of her population, there is an increased activity in all branches of manufacturing industry, including those that require the employment of a great number of operatives. Private capitalists risk an outlay of half-a-million sterling in the erection of mills and machinery, and do not entertain any dread of the stoppage of their works from want of hands; and in the manufacturing districts the rate of wages is increasing. And the pleasing prospect is indulged in that this increase will be diffused through all parts of the kingdom, with advantage to every class of the community. The employed naturally will derive benefit from augmented wages; farmers are expected to be compensated for increased expenditure in this serious item by a diminution of poor-rates, and the manufacturer by an increased demand for his fabrics.

The early example of North America has taught us that, though a scarcity of labour retarded the development of the wealth of the country, the then existing inhabitants lived in the midst of abun-

dance. It remains to be proved in England whether the old theory, that population always presses on the means of subsistence, be sound—or whether a full population may still advance, with increasing comforts, without any necessity for resorting to artificial means for checking its farther multiplication, the resources of the country being worked at high-pressure.

In England, even to remain stationary is to remain in a condition of actual prosperity; but in Ireland, not to advance is to retrograde; and if emigration be not there a step in the right direction, the retrogression will be attended with the most calamitous consequences. To a certain extent it has been admittedly a benefit to the country, by relieving it from a redundant unemployed population. The vast amount of the emigration leads to the inquiry, whether it is not exceeding its just limits? And supposing this to be the case, whether that excess will continue?—and if so, whether any means are available to retard, check, or, failing these, to supply the loss of population?

Mr Locke proposes three reparative agencies—"1st, The general progress of the people, industrial, educational, and social; 2d, A well-defined law of tenure, worked out in the spirit of its intention by the mutual good feelings and good sense of landlords and tenants; and, 3d, The improvement of the labouring class, including colliers and small farmers, whose profits or wages have been hitherto insufficient for decent maintenance. Now, the first-mentioned is abundantly manifest in the decrease of crime and the increase of agricultural improvement and general enterprise throughout the country. Of the second we may entertain a well-grounded expectation, the matter being in competent and zealous hands. And the administration of poor-law taxation, and substitution of independent capitalists for distressed or insolvent landed proprietors, who were unhappily incapacitated from fulfilling the responsibilities of their position, afford strong warranty for the improvement of the labouring classes, which is, indeed, already felt in the rise of wages and progress of industry in all its departments, agricultural, manufacturing, and commercial."

As to the first, we cannot, with recent events before us, place much reliance upon "the decrease of crime;" but, as we are anxious to hope even against hope, and to depend much upon a firm, vigorous, and unswerving administration of the law, we shall assume the decrease of crime, and admit the reality of a very slow "increase of agricultural improvement," but demur to a very "general enterprise throughout the country."

We fear that the all but unanimous opinion of those who have recently visited Ireland is, that enterprise does not exist, and that south and west of Dublin there is too generally perceptible the greatest neglect.

But supposing these three agencies—decrease of crime, increase

of agricultural improvement, and general enterprise throughout the country—in active operation, they would do but little to check the thirst for emigration. With the general progress of the people would come the desire for that new world with whose climate, soil, productions, &c., education had made them acquainted.

Assume the progress of Victoria to be as great this year as the last, and the discovery of gold still to continue, we should think that the very causes mentioned by Mr Locke would predispose to emigration rather than check it.

We pass to the second of Mr Locke's agencies—"a well-defined law of tenure."

This is a subject upon which we place very great stress. In the Number of this Journal to which we have already alluded, we expressed our opinions, and we see no reason to alter or modify them. The juncture of the times then presented unusual advantages for an improved law of landlord and tenant. Subsequent events have not lessened them; and we look forward with anxiety to the settlement of a question as important to the landed interest in Ireland as the law which transfers property with an indefeasible title.

The statistics supplied by Mr Locke give much information, and form groundwork for a history as curious as that of the previous plantations in Ireland.

It would appear that, from February 1850 to July 1852, 772 estates, or parts of estates, have been sold, in 4062 lots, to 2355 purchasers. The land that has changed hands is about 1,050,000 acres, or about one-twentieth of the surface of the island—the total area, exclusive of water, amounting to 20,177,446 acres.

The amount realised by these sales has been only about seven millions sterling; and Mr Locke, who is evidently favourable to the New Court, endeavours to account for the smallness of the rate of purchase, by mentioning that a considerable portion of the land sold, especially in Mayo and Galway, consists of mountain, bog, and unreclaimed tracts.

It is unfortunate that he does not give us more precise information on this head. He has supplied a great deal of useful statistical information—he has had peculiar facilities of access to sources of knowledge—and yet he omits this very interesting point: we believe that he shrinks from it.

His pamphlet, which had a very extensive circulation in Ireland, was extremely laudatory of the Encumbered Estates Court, and was written at a time when the prolongation of its existence was a matter of considerable doubt. It decried the Court of Chancery, and extolled that of Henrietta Street, and averred "that there was much misconception abroad as to the sacrifice of property under this act. Fee-simple estates, situated in solvent poor-law unions, where the tenants have not been demoralised by neglect

or mismanagement, bring generally over twenty years' purchase on the nett rental *in every part of Ireland.*"

This pamphlet produced a reply;* but being on the unpopular side, it did not obtain much publicity. It denied, however, the accuracy of Mr Locke's statements; and it was therefore more incumbent upon him, than upon any other living authority, to give information on this head.

The fact appears now that a twentieth of the area of Ireland was sold—from the first sale, Feb. 1850, to the end of July 1852—for about seven millions sterling. Taking the calculation in round numbers, let us see if we can in any way approximate to a safe conclusion of the average rate of purchase of the 772 estates or parts of estates sold. The case is deserving of investigation.

We are not given the rental of the estates sold; but as these properties have been distributed in most of the counties in Ireland, it is not an unfair mode of taking the average to assume that the million and fifty thousand acres sold contain the same proportion of bog and mountain that exists all through the island.

Let us endeavour to calculate, from such *data* as we possess, the rate of purchase of the 1,050,000 acres disposed of for £7,000,000.

The area of Ireland contains 20,808,271 statute acres, of which 6,295,735 are uncultivated.

Supposing, then, that 1,050,000 acres sold have a due proportion of uncultivated acres—viz., 317,687 acres—there has been sold 732,313 of arable or productive soil. If this alone be estimated as of value to the purchaser—and we average the acreable value at £1 yearly rent—he has paid £9, 11s. 2d. per acre, or about 9½ years' rate of purchase. If £1 per acre rent should appear too high, as a set-off we throw into the bargain the uncultivated acres, more than one-half of the average of which is bog, and capable of improvement, and much of it is very profitable for yielding fuel; and if this does not satisfy, we beg of the seeker for dead bargains to take into consideration the value of the mansion-houses, farm-houses, walled-in parks of very fertile soil, timber, mills, &c., which are merged in the general average of acreable price.

It is apparent that there has been a great sacrifice of property; and that property being encumbered, the junior creditors have suffered more than perhaps the proprietary, whose interests, assuming the real value to be that at which the estates were sold, were in truth but nominal owners. Other branches of Mr Locke's statistics show that the number of English and Scotch purchasers is but 114 out of the total mass (2355) of buyers.

* Ireland: the Encumbered Estates Court—should it be continued? Containing a reply to "Observations on the People, the Land, and the Law, in 1851." Dublin: Edward T. Milliken, 1852.

We confess our disappointment at this result; and the more so as even this number is but apparent, several of the purchasers being, in fact, mortgagees who were obliged to take the pledge that had been forfeited. They are not purchasers in the character of settlers, only money-lenders converted into landholders. It is, however, satisfactory to learn that the number of English and Scotch settler proprietors is on the increase.

Up to January 31, 1852, the purchasers were one-twenty-fifth as to number, and one-tenth as to the total amount of purchase-money. On referring to the tables, we shall find that, up to July 31, the proportion as to number is one-twentieth, and as to amount, about one-sixth of the total purchase-money. It is a fact, of considerable importance as affecting the improvements of the far west, that English and Scotch purchasers, and tenant-farmers also, have usually settled in groups. Thus 63,000 acres of Sir R. O'Donnell's Mayo estate have been purchased by English capitalists, led by Mr Ashworth, whose work, entitled *The Saxon in Ireland*, has been of great service to this country,—and now a large portion of Erris and the northern shores of Clew Bay is in the possession of Englishmen. Again, in Galway, another set of English purchasers, Messrs Twining, Eastwood, Palmer, and others, are grouped on the shores of Ballinakill Bay, and in the vale of Kylemore. Many tenant-farmers also, from the other side of the Channel, have settled in the western counties within the last three years. Large tracts have been taken on the Marquis of Sligo's estate by English and Scotch gentlemen; and many other landlords in the west have also induced skilful and enterprising agriculturists to settle on their lands, by granting long and beneficial leases at low rents; but I have no means of arriving at even a proximate estimate of their number. However, it will be observed that the greater extent of the English and Scotch purchases is in those western districts where the population has been most diminished, and where capital and improvement are chiefly required—three-fourths of the total acreage being in Galway and Mayo, and two-fifths of the total amount being invested in the same counties.

The fact that the greater part of the land which has changed owners and has passed into the hands of British purchasers is in the west of Ireland, whence the greatest emigration has taken place, and where it is, in many districts, almost cleared of the native population, is an evidence that it is not desirable to check the prevailing tendency to emigrate. New settlers will naturally seek those parts where they run no risk of those agrarian outrages which occur where the natives remain to contest the occupancy of every acre, and seal its price with blood. And we firmly believe that the great movement of the people from Ireland will, in many respects, be attended with important benefits to her agricultural and social interests. We have no dread of too great an exhaustion of the plethoric (numerically only) population. The world's history shows that, though there have been periodically spring-tides of emigration, the impulsive forces have only acted long enough to subserve God's design of developing the industrial resources of new countries through the superfluity of population in the old ones. The stream of emigration rolls forward; but when it attains its right level, the gradual subsidence of the current succeeds, and agriculture, manufactures, and commerce, attain a regular, unimpeded, and increased flow. The reaction will come, if we wait a little. The receding tides will cease to carry away

cargoes of families if they find remunerating employment and comforts at home.

In truth, the agricultural interests of Ireland have nothing to dread from the diminution of labourers, though Mr Locke calculates (in his paper read at Belfast) that, at the present rate of emigration, "the country will be denuded of its population in a few years."

If large tracts of arable land be here and there depopulated, there are other localities whose superfluities can soon supply the want. Nor do we even contemplate the necessity of importing labouring families into that country from this country, at what must be a very expensive cost, even if our British people could be induced to go there instead of turning their faces to the more favoured colonies.

There is human stock enough still in that island, if duly divided and located, and treated as in the most prosperous agricultural counties of Great Britain, as to food, raiment, and habitations. Wherever certain and steady employment, with good wages proportioned to the labours discharged, there would be no lack of workmen. But there is much in the power of both tenant-farmer and proprietor, enabling them to improve, by moral and physical means, the lot of the labourer, which the present mighty European drain has placed in a position eminently favourable to him. The British labourers themselves are departing with the stream that sets to the fields of gold, and we shall soon be indisposed to part with many more of them. The remnant of the Celtic population should be fostered and elevated in condition, and then these will be rendered efficient tillers of the soil.

It is no disadvantage to farmers taking large farms in Ireland, to find that they may square fields, level fences and old straggling walls, without injuring or offending any person; and with money in their pockets, and liberal dealing as to wages, they will assuredly find labourers: the vacuum will be speedily filled. There is but one thing to be dreaded, and that is, that the employers may find their cash running low for all the demands upon it.

Not long ago some of us urged the expediency of employing manual labour as much as possible in Ireland, in order to afford increased employment; and we would rather have dissuaded Irish farmers—even if they had capital to expend on such objects—from sinking any of it in the purchase of costly thrashing and reaping machines, &c., while men eagerly offered their muscle and sinew for a miserable pittance. But now the paucity of workmen is such as to render the introduction of machinery of every sort the most desirable palliative of the existing difficulties; and, as every sensible man well knows, the results of the use of such machinery will be ultimately beneficial to all the labouring classes

themselves, as well as conducive to the advancement of agriculture in all its branches. Let capitalists once take it into their heads to work the land like any other material of manufacture—as it ought to be wrought for profit if handled at all—and there will be inducements sufficient to the Irish peasantry for remaining at home in sufficient numbers to do the work of the country, while they themselves would be in a prosperous state. It is still the want of capital for employing labour which paralyses the country. Even in counties the soil of which is proverbially rich—near towns—in localities abounding in gentlemen's seats, and the residences of the most respected classes of society, men were anxiously soliciting work for 6d. and 8d. a-day, just previously to the last harvest. Though the fields evidently showed neglect from want of labour, the employing class, overwhelmed with land-rates, &c., and deriving no rents or profits from their untenanted lands, were unable to find the means of paying labourers even 3s. a-week each. An employing farmer going to such a locality, and prepared to pay 7s. a-week *regularly* to his men, would find that very few of them would desire to leave it: the amelioration of his condition would obviously tend to increase the disinclination which he naturally feels to leave his native land; and the scarcity of the supply of labour will also be productive of the same result.

One of the most unpleasant objects of contemplation to a person travelling through the western and southern counties of Ireland, is the view of the roofless hovels of evicted tenants, the walls of which are allowed to remain in their desolation, monuments of a nation's misery. We would fain see these mournful ruins either razed to the ground, or converted into labourers' cottages, with a small allotment of land attached to each. If the remnant of the Celtic peasantry were even now placed in the condition of observing the forethought, punctuality, disciplined labour, and scientific skill of the English and Scotch farmers—what may, in one word, be termed industrial economy, which must prove an invigorating graft on those wayward and procrastinating habits that have for so long a period impeded the improvement of the people (as Mr Locke has remarked)—the best effects would follow, as to the creation and establishment of an effective class of farm-labourers in Ireland.

And it is with extreme pleasure that we received the testimony of the Earl of Mayo, (recorded at the meeting of the British Association at Belfast, in September last, at which Mr Locke's paper, to which we have been referring, was read,) that the work of regeneration has commenced in a remarkable manner; that Englishmen were going, not to the cultivated, but to the uncultivated parts, under the impression that they would *there* double their income in a very short time; and that with respect to other parts of Connemara—say from Westport to Clifden—he (Lord

Mayo) was surprised to find the number of houses occupied by persons who were almost all Englishmen. If the new and solvent proprietors of estates, and employers of the peasantry remaining, would sympathise with them and better their lot effectually, such strong counteracting influences would arrest the progress of emigration beyond a desirable point. They are not, however, yet in operation, and therefore it is not wonderful that the labourer, who even now in parts of Ireland can be hired for 6d. a-day, will fly to that Eldorado to which his countrymen have preceded him.

Whether the writer upon whom we have been chiefly commenting be over-sanguine or not in his trust in the efficacy of the agencies that he has enumerated, it is not for us to pronounce that the time has gone by for artificial encouragements to emigration. It may yet be that, in addition to the counteracting influences suggested, specific tidings may come home that the promised land is not the paradise it has been depicted, and that the vast multitudes that have left our shores are more than sufficient for the exigencies and requirements of our colonies, and that a greater supply would be productive of an inundation.

We live in remarkable times, "each week of which is staggering under the load of events that it had formerly taken centuries to bend." We doubt not that the history of the present time will, in this particular, be similar to that of the past. It is a period of great anxiety, and one that requires activity, intelligence, and earnest watching. The pulse of the patient should be unceasingly felt by the state physician—the slightest favourable change noted, and made available for the regeneration of an afflicted country. She has passed through the midst of the valley of the shadow of death: may we, dare we, hope that her experience will not be entirely thrown away? The work of reformation having begun with the few, has now to pass through the whole agricultural fabric; and an improved system of tenure will benefit all the occupiers of land, whether small farmers or large farmers, and all farm-labourers. We shall venture on one more quotation from the pamphlet with which this article is headed.

National prosperity is not so much the consequence of natural resources as the necessary result of industrial and moral training. Productiveness, which is the creation of human labour, renders the colder and more sterile regions capable of sustaining dense and constantly increasing numbers; while the profuse natural luxuriance of more favoured climes, where food is a weed, but man ignorant and slothful, fails to keep a scanty and scattered population within the limits of subsistence. To bring the comparison nearer to our own times and circumstances—The necessity that energised the genius of the Dutch to war with the elements, and win a realm from the sea, paralysed the apathetic Irish in a country where earth, sea, and sky are all propitious to the husbandman. Again—Seventy years ago the counties of Haddington and East Lothian, now the best-farmed and highest-rented lands in the empire, were overrun with pauperism; but the introduction of moral and industrial education fostered the germ of improvement, and gradually elevated the character of the Scottish peasantry. And we are fain to hope that the chastening lessons of Providence, in forcing upon our notice the sources of national evils, have likewise inculcated the

knowledge of their true remedies; and that the rapid progress of a well-organised system of united instruction, suited to the social requirements of the people, has laid the foundation of results analogous to those which have occurred in Scotland, in spite of the opposition of those who would make religion itself the occasion of disunion instead of the bond of concord, and would leave the people in the darkness of ignorance that they might keep them in thraldom.

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THE FARMERS' NOTE-BOOK—NO. XXXVIII.

*Nitrate of Soda for Wheat.** By Mr TOWERS.—1. The subject of the Tullian system of agriculture, as modified by the Rev. Mr Smith, has been noticed by Professor Way in his valuable article upon "The power of Soils to absorb Manure," which has just appeared in the *Journal of the Royal Agricultural Society*, No. xxix., pp. 123-143. Several paragraphs, bearing upon the subject, and connected with the aforesaid power of absorption, demand particular attention; and upon some of these I venture to trespass, as being demonstrative of recently established facts. The first presents itself in the form of a question, thus—"Is it likely, on theoretical considerations, that *the air* and *the soil* together can by any means be made to yield, *without the application of manure*, and year after year continuously, a crop of wheat of from 30 to 35 bushels per acre, (imperial)?" 2. "I confess," Mr Way says, "that I do not see *why* they should not do so. We have seen the power which soils possess of abstracting ammonia from the air. This power is not confined to periods of rain; it is not even limited to the periodical recurrence of dew. So often as air charged with carbonate of ammonia comes into contact with the surface of a soil, so often will that soil be enriched by ammonia to the extent to which the air contains it."—p. 140. Again—3. "With ammonia comes carbonic acid; and as this gas constitutes 1 part in 1000 of air, it will be supplied in quantity nearly 10,000 fold more than the ammonia. I do not therefore see why, between the absorption of carbonic acid by the leaves, and its supply to the roots in a porous soil, sufficient carbon should not be derived from the atmosphere for all the wants of a growing crop of wheat. But here, again, we can only conjecture. It is impossible to say positively, on theoretical grounds, that such *would* be the case; but, on the other hand, it is equally impossible to deny that it *might* be." 4. "With regard to the *mineral matters* required by a crop of wheat, the inquiry is far more simple. We know very accurately how much the different parts remove from the soil of

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* The word printed "*leaders,*" line 21, p. 419, of this Journal for July 1852, should be read "*leaves.*"

potash, *magnesia*, *phosphoric acid*, &c.; and we know that, if they are not added in manure, they must be derived from the internal resources of the soil itself—for the air will do nothing here." In the annexed table Mr Way gives "the quantity in pounds of the different mineral substances required by a crop of wheat yielding 35 bushels of grain, and 2 tons of straw and chaff; a second column of the table shows the amount removed by twenty such crops; and in a third will be found the *percentage* of each which a soil must contain to furnish this last quantity:"—

	One crop.	Twenty crops.	Percentage of the soil removed by twenty crops.*
	lb.	lb.	
Silica, . . .	170	3400	0.152
Phosphoric acid, .	30	600	0.027
Sulphuric acid, .	8	160	0.007
Lime, . . .	16	320	0.014
Magnesia, . .	10	200	0.009
Potash, . . .	40	800	0.036
Soda, . . .	3	60	0.003
	277	5540	0.248

The question concerning the value, absorption, and fixation of carbonate of ammonia appears to be satisfactorily answered—and every experiment tends to prove the fact; but, as concerns other salts with alkaline bases, evidence is less conclusive. Potassa, however, is thought to be in every way preferable to soda, though so much has for many years been written in favour of the free application of common salt, and the nitrate of soda. Mr Way observes, that "it is common and usual to find from one-tenth to two-tenths per cent of potash in ordinary soils—a quantity greater than is here, in the above table, shown to be required for a crop of wheat. The fact is, that there is an almost unlimited supply of the mineral requisites of plants in soils, but that the great agricultural problem is to get them."

Mr Way's discoveries of the powerful agency of the double *silicate* of *alumina* and *lime* tends much to interpret the phenomena of absorption; but the cultivator must not forget that the absorptive power is not by any means restricted to *ammonia;* for we have seen, and also made the fact public, that *soil arrests the colouring matter of liquid manures*, and of guano in solution—entirely deodorising the fetid solutions of all putrefying vegetable matters. Observant gardeners were aware of these facts, and knew well that by pouring a quantity of foul-manure water through

* Calculated on a soil 10 inches deep, and weighing 1000 tons to the acre.

the soil contained in a common garden pot, the liquid that passed through the hole at bottom was either wholly purified, and deprived of taint and colour, or to an extent equal to the capacity of the soil. Chemists, within the last two or three years, have confirmed the truth of the practical man's experience, and now have proceeded a considerable way towards the scientific elucidation of causes. Witness the excellent article of Professor Way, above referred to.

Whatever may be thought of the principle of successive crops on Tull's system, as improved by Mr Smith, we must be permitted to contend for the occasional addition of putrescent substances—such as farm-yard and fold manure—not on the old ground of *simple enrichment*, but inasmuch as their decomposition produces a continuous current of electricity, which attracts, decomposes, and effects new combinations, corresponding with the requirements of each individual plant. Thus we may, I think, safely consider *the electricity* evolved by the play of invisible but definite chemical affinities as the fountain of vital action; and hence the paramount necessity of a certain quantity of *humus*, or its elements, in all land which is expected to bring a remunerating grain crop to perfection. The question of the possibility of the improved Tullian system depends for a satisfactory answer upon the correctness, or otherwise, of the electric theory thus suggested; and I now bring the subject to a close, by observing, with Professor Way, that although " a considerable number of successive wheat crops might, by virtue of the manure-collecting and manure-preparing process of abundant cultivation, be raised from land without the direct application of manure, I am decidedly opposed to the principle of continuing this system on the same land for an *unlimited* number of years. What is to prevent land, that has been cropped successively with wheat on this plan for ten or fifteen years, supposing it has been found to answer for that period, from being changed for other land which has not been exposed to that drain?"

It would be impossible to do justice to Mr Way's paper without copying nearly the whole of it. The reader curious on such subjects would profit by a careful perusal. It deals with facts and phenomena purely chemical; but the practical cultivator of land, as a matter of profitable return, while appealing to chemistry as an interpreter, must exercise a discriminating eye towards the appreciation of results. Mr Smith has, I believe, resolved to interpose *green crops* as an alternating routine: if so, we may anticipate the introduction of *humus* elements, in one form or other, as a preparation for turnips, kale, or any other member of the *Brassica* family. I trust Mr Smith will firmly persist in the development of his objects, and favour the agricultural reader with a statement of results.

2. I now approach the subject alluded to at p. 410, No. 37, of

this Journal, in my paper upon "Agricultural Chemistry," namely, *Nitrate of Soda for Wheat.* It will be within the recollection of most readers in that branch of cultural science, that this salt, some ten or twelve years ago, was not only fashionable as a manure, but much favoured as *a surface dress for grass lands.* Mr Pusey wrote upon it an article, in vol. xii., part i., of the *Royal Agricultural Journal* for 1851; and from that paper I extract the passages which follow, before I venture to offer any suggestion on the *rationale* of the specific agency exerted by a chemical salt composed of *soda*, as a *base*, neutralised by the *nitric* acid—itself a compound of *nitrogen* and *oxygen*, united in the proportions of one part or volume of the former with five of the latter.

Mr Pusey was induced to experimentise with this nitric salt, (formerly called *cubic* nitre, in contradistinction from common *salt-petre* nitre, the base of which is potash,) "by having read that some very good farmers in Norfolk make a practice of top-dressing their wheat in spring with nitrate of soda. I determined," he says, "once more to try this salt, the use of which was discontinued, in consequence of its tendency *to lay the corn*, and to *produce mildew.*"

Observing that both these faults appeared to be corrected by the addition of common salt, he made the following experiments:—

1st. On a 10-acre piece of white wheat, a portion thereof being passed over. *Nitrate of soda* was sown at the rate of 1 cwt. per acre, mixed with the like weight of *common salt:* the whole quantity was not given at once, but divided into two doses, applied at a fortnight's interval, and in showery weather. A portion was top-dressed with guano only. The results are thus tabulated:—

	Bushels per acre.	Increase in bushels.	Cost.	Value of increase.
Undressed, ...	21	...	...	...
Guano, 2 cwt., . . .	24	3	20s.	15s.
Nitrate and salt, each 1 cwt.,	25½	4½	17s.	22s.

2d. Trial on an 8-acre piece of red wheat following barley. The improvement was immediate, though the wheat had begun to appear blue and spindling, notwithstanding a good coat of dung given in the autumn to make up for cross-cropping. Two acres were thrashed, one on each side, the half in the middle, on which no nitrate was sown. The soil a poor blowing sand. The results were:—

	Bushels per acre.	Increase in bushels.	Cost.	Value of increase.	Profit per acre.
Undressed,	19¾	...	...	...	...
Nitrated,	27¾	8¾	17s.	42s.	25s.

Now the question presents itself—How does nitrate of soda produce so marked an improvement upon the wheat crop? Mr Way has observed, in his lately published article on the absorbent power

of soils, that "almost all those chemists who have been much engaged in the examination of the ashes of plants have come to the conclusion that *soda* is not necessary to vegetation—that is to say, not as a constituent of plants."

Mr Pusey, on the authority of Lawes' experiments, concludes that "*nitrogen*, whether as ammonia in guano, or as a *nitrate*, is proved to be the food generally wanted for wheat."

We were taught by experience that *nitrate of soda* produced so manifest an effect upon grass, increasing its luxuriance, and deepening the intensity of its verdure, that when a little of the salt, finely triturated, was trickled on the mown lawn, the grass in growing would clearly indicate by its deeper colour any letters or figure marked out by the nitrate. But in Mr Pusey's experiments, the salts employed became, when dissolved by rain, a *nitro-muriate*, or, more correctly speaking, a *nitro-chloride* of soda! On this point Mr Pusey says, "As to the practical application of nitrate *with salt*, I speak with diffidence, but I should look to it more for curing defects in a crop arising from season, or from poverty of soil, than for raising a good crop to a very high figure upon good land. Indeed, in looking over the experiments made ten years ago, I find that nitrate sometimes does not act at all upon good land."

Another paper on *nitrate of soda* as a top-dressing for wheat, is found in the last part, just published, of the *Royal Agricultural Journal*, vol. xiii. It is addressed to Mr Pusey, by Mr Keary of Holkham. One paragraph (p. 201) reads thus: "I am decidedly of opinion that *nitrate of soda* is a most useful and profitable top-dressing for wheat, upon all light *gravelly* and *sandy* soils, if properly and judiciously applied. The addition of *double* the weight of *common salt* I hold to be most important: it *corrects* exuberant growth of straw, which nitrate of soda alone produces, stiffens it, and prevents the crop being laid; and, what is even more important, materially improves the quality and weight of grain." In proof of the latter effect, an acre of the soil at Holkham, without any manure as top-dressing, yielded, in 1851, 37 bushels, but with 10 stone of nitrate of soda, and 20 stone of common salt, each 14 lb. to the stone, the table gives—cost of dressing, £1, 3s. 3d.; corn, 47 bushels; increase, 10 bushels; straw, 1 ton 18 cwt. 4 stone; increase, 11 cwt. 2 stone. But as to the former point—the improvement of the straw—the question presents itself: Could it arise from any other cause than the greater and more regular deposit of that *flinty coating*, which glazes the straw? Here, as I have no desire to hazard any theoretic notions of my own, I would advise the chemical reader to peruse with the greatest attention Mr Way's suggestions on the "Influence of Common Salt," at page 137, No. 29, of the Journal mentioned above. But how, we may ask, does nitrate of soda act? Is it the *nitric acid*, *or its base soda*, or the two combined, which can induce the prolificity of

the wheat crop? To obtain an answer satisfactory to myself, I proceeded thus, commencing the experiments September 30th last:—

1st. Collected earth from the middle spit of a garden of a friable sandy nature, poor in aluminous matter. Suffered it to become so air-dry as to fall regularly into a drainer bottle, the neck downwards, and tied over with a piece of muslin. By patting and gentle pressure, the soil (say 9 inches in depth) was equably distributed, and made nearly level.

2d. Weighed 2 scruples (40 grains) of crystallised carbonate of soda, dissolved it in rain-water, then dropped in the liquor, (concentrated nitric acid,) sufficient to neutralise the soda, (as proved by litmus paper and turmeric paper,) and made up the quantity 4 fluid ounces; which quantity was carefully poured over the surface of the earth, and left to digest with it, none passing through, during 3 hours. Rain-water was added till drops fell into the receiving-glass; and the earth, being thus saturated, was left all night. In the morning, about 1 ounce was found in the receiver, and this was returned over the soil. The filtrate then became clear and colourless. To the *taste* it appeared *neutral* as to acid or alkali, and *flavourless*, otherwise than by a sensation on the tongue of a heavy flatness, like that of chalky hard water become stale by exposure. Test papers gave no sign of either acid or alkali. About an ounce more rain-water was twice used, and the whole of the filtrate returned, excepting 40 minims retained in a measure-glass, which, tested by 3 drops of oxalate of ammonia, yielded a precipitate of oxalate of lime, so copious as to mark 5 minims of the glass, at which level it remained more than a day. On the 2d October, fully 2 fluid ounces were removed; an ounce more water produced an equal drainage, still abounding with a salt of lime; but two more ounces of water seemed to bring away most of the soluble matter. These filtrations consumed 3 days.

3d. Tests.—One ounce and a half by measure—that is, half the quantity of the strong filtrate—being evaporated slowly in a glazed capsule, left a quantity of acrid whitish matter, which, on applying 3 drops of concentrated sulphuric acid, emitted copious pungent fumes of *nitric acid*, and left a pasty mass of *gypsum*, (sulphate of lime)—proofs both that the nitrate of soda had been decomposed by the earth parting with its soda to the earth, which there remained fixed, and receiving in exchange a quantity of *lime* equivalent to the nitric acid thus set at liberty, and discharged as nitrate of lime. These facts are not alluded to as discoveries, since they have been established and proved over and over, and published in the Journal before named by Thomson and Way, but chiefly with the express object to induce a serious inquiry concerning the role performed by the *nitric acid*, inasmuch as it appears the fashion of the day to ascribe its fertilising power to *the nitrogen* which it conveys into the land, *there* becoming the source or base

of *ammonia*, now supposed to be a pabulum of vegetable nutrition. But in our experiments the nitrogen is lost, since it has been discharged with the nitric acid combined to saturation with lime as a nitrate. Again, what has become of the *soda*, and what the part which *it* has been called to enact in the wonderful transmutations that have thus been effected in secret? Is the *ammonia* (if such, indeed, be a necessary result) dependent for its existence on the *soda*, attracted by some invisible element in the soil? Here, then, and in honour to him to whom the honour is due, I must refer to Mr Way, who in his last article has treated copiously and luminously of those peculiar combinations called by him *double silicates*, of which his list enumerates and describes—first, the double silicate of *alumina and soda;* second, of alumina and *lime;* third, of alumina and *potash;* and, fourth, of alumina and *ammonia.* Referring in justice to Mr Way, No. 29, pp. 129 to 139 inclusive, and repudiating, so far as my several experiments have proceeded, the idea that *ammonia* is a direct or primary development when nitrate of soda is used as a dress for wheat, I close my remarks at present by stating, that when the *filtrate* was tested for *hardness* by the alcoholic solution of Castile soap, a minute droplet, not larger than a grain of cabbage-seed, being placed gently on its surface, a fibrous coagulum was instantly formed, very curious in figure, and decisive of the fact that lime must be present in all soils which yield salts of lime whenever alkaline matter is absorbed, and fixed during the process of filtration; and in the present instance, I look upon it as certain that the agent, undiscoverable as it is by ordinary tests, must have been the double silicate of lime and alumina of Professor Way.

2. *Agricultural, or, as it is termed, superphosphate of lime.*—I had announced my intention to offer suggestions upon this chemical manure; but having already extended my remarks, I prefer to recommend the careful perusal of the article at page 204, *Royal Agricultural Journal*, vol. xii., in which Mr Way has done justice to his subject as a scientific chemist, and has exposed the shameless frauds that are imposed upon purchasers by unprincipled dealers. There is one point of some moment on which I venture to differ from the writer; it will be found at page 229 of the aforesaid article, "On the Practical Suggestions for the Making of *Superphosphate of Lime.*" Two kinds of sulphuric acid are alluded to—one, the *concentrated*, commonly known as oil of vitriol, valued at £10 per ton; the other, called the "brown acid," at £5. "A saving," it is said, "of rather more than £1 on every ton of superphosphate would be effected, *using the brown acid*"—"it is much more economical to employ the weaker or *brown* acid." As a chemist, formerly in the habit of preparing tons of bones by distillation, and the di-phosphoric acid from them, I should object to the brown acid; but I cannot give so strong an opinion on the

other question. However, upon consulting a druggist who sells great quantities to farmers who prepare their own superphosphate, and to an extent of 5000 lb. to one party, I was assured that experience had established a decided preference in favour of the *concentrated* sulphüric acid—that is, the best commercial oil of vitriol. Experience must decide.

Origin of the Domesticated Animals.—It is a very common remark, that, while we are very much astonished at the merest trifle that is new to us, we behold with indifference the most wonderful things with which we are very familiar. There is not, perhaps, a better illustration of this than the domesticated animals. We every day witness them around us, and yet scarcely ever wonder at them. And yet it is very wonderful that the domesticated animals should live subservient to man, and apparently entirely for him. The cow not only gives milk for a few weeks after parturition to nourish her calf, but continuously, or nearly so; the sheep forms wool, not for its use, but its master's; the horse, with scarcely any instruction, performs the various offices of the draught; and the dog not only attaches himself more to man than to his own species, but even understands and obeys the language of its owner.

There is a wide difference between "taming" and "domestication." Any animal may be tamed, and many frequently are; as, for example, otters, squirrels, and even lions. But the offspring of such tamed animals are born with the instincts and propensities of wildness, and if they are to dwell with man, require as much taming as their sire did. But the young of domesticated animals are born tame, and willing to submit to man, and to have tasks and labours imposed upon them.

It is almost unnecessary to say, that, although the number of wild animals that may be tamed is very large, that of the domesticated is very small, and only includes the dog, the ox, the horse, the ass, the sheep, the goat, the pig, and the various kinds of poultry—in this country; with the camel, the elephant, &c., of other countries. Two theories prevail regarding the origin of these domesticated breeds. One supposes that they have all arisen from parents originally wild, that have been tamed by man, and kept tame for so many generations, that they have acquired the habit of tameness and the other habits of domestication. The other asserts that these races were created domesticated, for the use of man, and were from the beginning such as they are now.

Those who support the latter opinion maintain that no types of the domesticated animals are to be seen in a wild state. There are, indeed, in America plenty of wild horses, wild cattle, and wild pigs; but these, we know, are merely the descendants of domesticated animals of the species introduced into the country not three centuries ago. Farther, if taken under human protection, indivi-

duals of these so-called wild breeds can, without any trouble, become again subjected to the influence of man, and their progeny retain their domesticated habits and propensities. Those who advocate this view farther allege, that to suppose that man by art subdued the different domesticated animals, presupposes that man himself was once savage; and they say, that if man had not been originally created civilised, he would have remained a savage to this day.

For our part, we have never held this view, nor have admitted the strength of the above arguments. We believe that all our domesticated races have been artificially procured from wild ones. And as which of the two opinions is right is not a mere abstract question—inasmuch as, if one view be true, we can never hope to have a greater number of domesticated breeds than we have at present; whereas, if the other be the right one, we can multiply them almost at pleasure—the following arguments in support of our sentiments on this matter may not be out of place.

In the first place, then, we hold that there is unquestionable evidence that man once was a savage. At the present day, we see whole nations of savages, quite capable, nevertheless, of civilisation, and many of whom are becoming civilised. Farther, we know that all the present civilised nations of Europe are the descendants of savages. Nay, what is more, the original inhabitants of these islands, and of the rest of Europe, and, to a certain extent, our ancestors, are now ascertained to have been more savage than almost any tribes of so-called savages now existing. It is proved beyond a doubt, that the Allophybyan inhabitants of the world were unacquainted with metals, dwelt in subterranean excavations, and were in every respect most wretched creatures. And it is almost certain, from the researches that have been made, that the ancestors of the Grecians and Romans were in a like condition. We take it, then, to be now undeniable, that civilised man has only become so by degrees, and that, as far as arts and a knowledge of science went, original man was a savage.

Secondly, we know from geological observations, that very long, probably many thousands of years before man was created, some of the species of domesticated animals had an existence. Oxen, for instance, were common in the periods in which many of the tertiary formations were deposited; so also was the horse;—and it is a familiar fact, that the elephant, perhaps the most thoroughly domesticated of all animals save the dog, had a pre-Adamite existence. The existence of these domesticated breeds, long before man was called upon the scene, appears to us a strong argument against the opinion that they were domesticated from the beginning.

Thirdly, we are entitled to infer, that the different breeds of subjected animals have been domesticated by degrees; and that, in

particular, the dog was subdued long before the horse was. Researches made into sepulchral monuments have made it probable that, in the progress of man from the state of a savage to that of a civilised being, three periods can be distinguished;—the stone period, during which the inhabitants were only acquainted with stone as a material for implements and weapons; the bronze, in which they had obtained a knowledge of the properties of copper and tin; and the iron period, which last was the one immediately preceding the historical, and during which mankind became familiar with iron. Now, in examining the houses and sepulchres of the inhabitants of the stone period, we find the bones of dogs, and there can be little doubt but that these are the bones of domesticated dogs; we also find the bones of oxen, and it is impossible to say whether these are the remains of the skeletons of wild or reclaimed cattle; but we find no bones of the horse until we come to the examination of the graves, &c., of the men of the iron period, when they become common. It is needless to point out how incompatible the gradual subjection of different breeds of domesticated animals is with their being created ready domesticated.

Fourthly, although it is difficult to fix upon an existing wild species from which the sheep, for instance, has been derived, yet, in the case of the dog, for example, we may conclude that it has been derived from the wolf. Wolves and dogs breed together quite as readily as dogs of different kinds do; the period of gestation in each is sixty-three days;—and the difference in their organisation, &c., is simply, the wolf has his hair of a uniform deep grey colour, while that of the dog is variegated; the tail of the wolf is bushy, and that of the dog not; the wolf howls, and the dog barks; and there is a little difference in the shape of the crania of the two animals. But if the dog be allowed to run wild for some generations, his cranium comes to resemble that of the wolf; his tail becomes bushy, his hair has a uniform grey tint, and he no longer barks but howls. He has, in fact, returned to his original type; and if he remained long enough in this wild state, would probably soon altogether cease to differ in any appreciable degree from the wolf. On the other hand, although a wild wolf has never been domesticated—*i. e.*, put into that state that its pups are born tame—yet the ease with which it is tamed, and the affection that it shows, indicate the possibility of this.

In point of fact, the domestication of, at any rate, dogs and horses, is to a certain extent still going on. For example, sporting dogs not only learn new modes of sporting, but they transmit their education to their posterity; and horses acquire new habits, which their descendants inherit. The improvement of domesticated animals kept for food is also notorious.

Just as we see the domesticated animals improving by slow degrees, we have a right to infer that, if restored to a savage life,

they would degenerate as slowly; and to this it is, we suspect, that we must refer the condition of the so-called wild horses and cattle of America. Regarding them in this view, we can understand how it comes that they can be readily reclaimed by man. Neither is it correct to say that we do not know the original of any of our domesticated animals, and that none such still exists in the wild state. All naturalists are agreed that the domesticated hog, a creature of diurnal habits, is descended from the wild boar, a creature of nocturnal habits. We have here, then, an instance of two breeds, one domesticated, and the other not, both sprung from a common source, and although altogether differing in habits, appearance, and even in internal structure, proving, by breeding together, and by the offspring so produced being fruitful, that they are one and the same stock.

Although foreign from our present purpose, we may perhaps be excused for remarking, that the domesticated pig has been used for human purposes before his death. In China, sows are regularly milked; and in the Balearic Islands it was, and perhaps is, the custom to employ swine as beasts of draught. In this locality the rule, we believe, was to yoke a pig and an ass together. But there is actually some evidence that swine were formerly employed for this purpose in Scotland. Pennant, always considered an accurate enough person, maintains that this was the case with regard to Morayshire. "I have been assured," he says, "by a minister of that country, eye-witness to the fact, that he had, on his first coming into his parish, seen a cow, a sow, and two *trogues*," (we suppose galloways* are meant by this word,) "yoked together, and drawing a plough in a light sandy soil, and that the sow was the best drawer of the four."

To conclude, we believe that all the original stocks of domesticated animals have been originally wild, and that they have been subdued by man. We farther believe that other animals might, if it were considered desirable, be added to the list of our subjects, although we suspect that the mode of *rapidly* reclaiming wild animals has been lost. In our last Number we ventured to enumerate some vegetable crops that are not grown in this country, which might possibly be advantageously cultivated. In our next we will attempt to state those animals that perhaps it may, at some future period, be considered desirable to domesticate.

The comparative Value of White Scottish Oats and Black English Oats. By Dr AUGUSTUS VOELCKER, Professor of Chemistry in the Royal Agricultural College, Cirencester.—White oats are generally considered more valuable than black, and Scottish, in

* Jamieson says that Trogue denotes "a young horse;" and as the phrase is used in Upper Clydesdale, it cannot be supposed that it refers to the galloway, which is a south-country breed of ponies, under fourteen hands high.—EDITOR.

particular, are usually preferred to those grown in England, it being the opinion of practical men that the former possess greater nutritive properties than the latter. The direct proof, however, that this is really the case, as far as I am aware, has not been furnished; at all events, it has not been shown to what extent the feeding properties of the two varieties differ.

With a view to supply this deficiency, I examined, some time ago, specimens of white Scottish and black English oats, and am enabled by the results of this examination to furnish a direct and positive proof of the correctness of the opinion above stated.

Black oats can frequently be obtained in the market at a much cheaper rate than the white Scottish; but as the first are inferior to the latter in feeding value, as will be shown presently, the question naturally suggests itself, Is it more economical to buy white Scottish oats at a higher, or black English at a lower price? An answer to this question has a direct practical bearing, and I shall therefore endeavour to point out how far the difference in the cost price of both is compensated by the greater nutritive properties of the Scottish sample.

The commercial value of different kinds of wheat, barley, or other grains of the usually cultivated cereals, is influenced in a great measure by the relative proportions of bran and flour, which different samples of the same grain furnish to the miller. The various kinds of oats, especially, furnish greater differences in the proportions of husk and meal than probably any other grain. Whilst some yield as much as three-fourths of their weight of oatmeal, others yield only 10 parts of meal from 16 of grain; and some samples of inferior quality produce but one-half their weight of oatmeal.

My attention was therefore naturally first directed to the determination of the relative proportions of husk and meal, which the two specimens of white Scottish and black English oats yielded.

1. In the white Scottish I have found in 100 lb.—

Oatmeal, ...	71½ lb.
Husk, ...	28½ ...
	100 ...

2. In black English oats the proportion of husk and meal in 100 lb. was as follows:—

Oatmeal, ...	66¼ lb.
Husk, ...	33¾ ...
	100 ...

100 lb. of Scottish oats thus yielded 5¼ lb. more meal than the black English. The former is thus decidedly more valuable than the latter.

Oats, however, are generally sold by measure, and not by weight.

The weight of a bushel of oats, it is well known, is subject to great variations, some kinds being considerably heavier than others. In order to draw a fair comparison between the relative value of the two varieties of oats, it was necessary to determine the weight of a bushel of each, and to calculate from their relative weights the yield of meal which each variety furnished per bushel. One bushel of white Scottish oats was found to weigh 42 lb.; the bushel of black English oats weighed only 37½ lb. The price of the former at Cirencester was 20s. per quarter. English black oats were offered at Cirencester for 15s. 6d. per quarter.

Let us now calculate from these data how much oatmeal these two varieties furnished respectively.

1. *White Scottish Oats.*—100 lb. yielded 71½ lb. of oatmeal: 1 quarter accordingly produces 240¼ lb. of oatmeal, for—

Oats.		Meal.		The weight of 1 quarter oats.		Meal.				
100 lb.	:	71½ lb.	=	8 × 42	:	x	.	x	=	240¼ lb.

240¼ lb. of Scottish oatmeal are thus obtained at an expense of £1.

2. *Black English Oats.*—100 lb. yielded 66¼ lb. of oatmeal. 1 quarter will thus furnish 198¾ lb., for—

Oats.		Meal.		The weight of 1 quarter oats.		Meal.				
100 lb.	:	66¼ lb.	=	8 × 37½	:	x	.	x	=	198¾ lb.

198¾ lb. of English oatmeal, according to the above-mentioned price, will cost 15s. 6d.; or, for £1, 256½ lb. of oatmeal can be obtained.

Thus, by expending £1 for oatmeal, 16¼ lb. more meal can be got, if black English oats are bought at the price of 15s. 6d., the cost of white Scottish oats being £1 per quarter. Or for 1s. I can get 12 lb. of meal prepared from white Scottish oats; whilst for 1s. I can get 12 lb. 13 oz. of meal prepared from black English oats.

Supposing both kinds of oatmeal to possess equal nutritive and commercial value, according to these determinations, a saving of about 1s. 4d. for every quarter would be effected by preferring the black oats to the white. Such a supposition, however, is not admissible, since it is well known that the relative nutritive value of different samples of oatmeal is subject to considerable variations.

The nutritive value of different samples of grain, so far, at least, as it is dependent on their power of producing muscle, is usually estimated by the greater or smaller proportion of protein compounds which they yield on analysis. It appears to me, therefore, necessary to determine by analysis the percentage of these valuable compounds in the oatmeal prepared from the white and the black oats.

a. 18.31 grains of oatmeal, from white oats, dried at 212° F., gave 6.88 chloride of platinum and ammonium, or 2.59 per cent of nitrogen, which is equal to 14.743 per cent of flesh-forming substances.

b. 13.60 grains of oatmeal, from black English oats, dried at 212° F., gave 4.83 of chloride of platinum and ammonium, or 2.230 per cent of nitrogen, equal to 13.94 per cent of flesh-forming substances.

We thus see that Scottish meal possesses greater nutritive value than the meal prepared from black English oats. It is true, the difference in the proportion of flesh-forming principles in both kinds of oatmeal is not very great, but still the superiority of the Scottish sample in this respect appears to us more than sufficient to compensate for the greater price at which the white oats were bought. Apparently the difference in favour of the black English oats is 4s. 6d., but we have seen that it actually amounted merely to 1s. 4d. per quarter, supposing both kinds to possess equal nutritive value—which, however, is not the case.

Taking the greater nutritive value of the white oats into consideration, we are inclined to consider it more economical to pay £1 for white than 15s. 6d. for black oats.

It will hardly be necessary to mention that the above observations apply merely to the two samples of oats which have been examined, and not in general to all kinds of Scottish and English oats.

The Composition of Rice-Meal or Rice-Dust. By Dr AUGUSTUS VOELCKER.—Rice-meal, rice-dust, or rice-refuse, which is obtained in cleaning rice for our market, consists of the husk and external layers of rice, together with fragments of the grain itself, and some accidental foreign impurities. This refuse has been used by several practical feeders with advantage in the feeding of stock. Whenever it can, therefore, be obtained at a moderate price, rice-dust will be found a valuable article of food, provided it is given to cattle judiciously along with other more substantial food. We fear, however, that this refuse is sold often much above its real value, and it appeared to us necessary, for this reason, to determine its value by analysis. From the manner in which rice-dust is obtained, we cannot expect it to be of uniform composition, but the following analyses may be taken as representing the composition of a fair average sample of unadulterated rice-dust. The sample analysed was offered for sale at £3, 12s. 6d. in London, or, with expenses for carriage to Cirencester, would have cost £4, 5s. 6d. per ton.

a. Percentage of water.—Dried in the water-bath, it lost 12.019 per cent of water, or about the same quantity which common flour loses on drying.

b. Percentage of ash.—Burnt in a platinum capsule, a whitish ash was left behind, amounting to 13.49 per cent of the whole weight of the meal in its natural state. The greater portion of the ash, namely 9.83 per cent, consisted of insoluble matters,

chiefly carbonate of lime and silicic acid, with some phosphates; the smaller portion, namely 3.66 per cent, was soluble in water, and consisted of soluble salts, chiefly alkaline chlorides.

c. Percentage of protein compounds.—The proportion of flesh-forming substances in rice-dust was calculated from the percentage of nitrogen, obtained by burning the substance with soda-lime, according to Will and Varrentrapp's methods. In two combustions, precisely the same quantity (6.687 per cent) of protein compounds was found.

d. The oil in rice-dust was determined by digesting the substance repeatedly with ether, in which the oil is readily soluble. On evaporation of the several ethereal extracts, a yellow sweet oil remained behind, which amounted to 5.610 in the natural substance.

e. Woody fibre, starch, and *sugar* were determined in the usual manner.

The following numbers represent the composition of this sample of rice-meal or rice-dust:—

Water,	12.019
Woody fibre, containing insoluble inorganic matters, 9.83,	46.500
Starch, gum, and sugar,	25.524
Protein compounds, or flesh-forming constituents,	6.687
Fatty matters,	5.610
Soluble saline substances,	3.660
	100.000

These analytical results suggest to us the following observations:—

1. That this refuse is very rich in oily or fatty matters. It contains, indeed, as much fatty substance as the best oats, but is inferior in this respect to Indian corn, which contains rather more oil. Rice-dust, for this reason, is well adapted for the laying on of fat upon animals.

2. In rice itself, according to Payen, only 0.8 per cent of fatty matters occur; and we find thus, that, as in most other kinds of grain, the fat is chiefly deposited in the exterior part of the seed.

3. Harsford found in the grain of rice 6.27 per cent of protein compounds in its ordinary, or 7.4 per cent in its dry state. In rice-dust I have found nearly the same quantity, namely, 6.687 per cent, in its natural state, or 7.600 per cent in its dry state. As far as the power of producing muscle is concerned, rice meal or dust appears to be fully as valuable as the grain of rice itself.

4. Rice-dust contains nearly half its weight of woody fibre, which possesses little or no value as a feeding substance. The exact quantity amounted to 46.500, which, added to 12.019 of water, gives 58.519 per cent of useless matters.

It has already been mentioned that the price of this refuse per

ton, delivered at Cirencester, was £4, 5s. The practical question, which chiefly interests the farmer, is, Will it pay to buy rice-dust at this price, in preference to barley, oats, Indian corn, or any other kind of corn? We should say decidedly that it would not pay at this price. Crushed oats of good quality, which can be had at about £6, 6s. to £7 per ton, contain the same quantity of fatty matters as rice-dust, but at least double the quantity of flesh-forming constituents, and also once as much starch, gum, and sugar, as rice-dust. Oats appear, therefore, at least twice as valuable as this refuse; and the price of the latter should, for this reason, not be more than about £3 to £3, 5s.

Barley-meal is not quite so nutritious as oatmeal, but, taking into consideration that barley-meal does not contain so much husk as oats, and comparing its composition with that of rice-dust, we think that barley-meal may be considered as possessing once as much value, as a feeding substance, as rice-dust, without committing any great practical error. Barley-meal, however, can be had at £7 per ton.

Effects of Agriculture upon Climate.—The all-important effect of climate upon agriculture is well known. It is, indeed, upon the climate of a district, far more than upon its soil, that all farm operations depend. A field that is barren from the want of lime, or of organic matter, can have its fertility restored by the addition of these substances; but no art of man can make a crop come to maturity in a field, the heat of the air over which does not attain the necessary temperature: that is to say, that while there are many difficulties that the intelligent agriculturist can master, there is one that he must always submit to—and that one is climate.

The degree of heat necessary to bring a crop to maturity varies with almost every different vegetable. Wheat cannot ripen where the mean summer heat is less than about 60°, or in latitudes farther north than 60°, the locality planted being on a level with the sea; while barley ripens when the summer-heat is only 41°, and rye can grow even farther north. Even very minute distances often produce very great differences. Thus, mangold-wurzel attains a very large size about London, but cannot be depended upon to give a good crop in the neighbourhood of Edinburgh; buckwheat, that does well enough in the middle of France, will not ripen every year in the south of England; and maize, which ripens in Canada at a latitude of 40°, is not suited to the climate of this island. Every elevation of 100 feet above the level of the sea makes a corresponding difference in the mean annual temperature; and crops that will do well enough in the plain, often in the same district cease to be valuable upon the hill. And there is a long interval between the climate that will produce

an abundant crop, and that which will not ripen the same crop at all. Between districts bearing full crops and districts bearing none at all, there are those that produce a kind of crop, indeed, but one not remunerating to the farmer. It is to a want of ability to discriminate the climate of a particular farm that the greater part of the farming that does not pay is to be attributed, and to the same cause must be ascribed the impracticable improvements that are so often urged upon the agriculturist. In farming, "muck is the mother of money;"—and a farmer may have muck *ad libitum*, and every other necessary condition; but if he have these, and farm in the face of the climate, he will never obtain a good crop.

Seeing the great influence that climate has upon farming, it becomes a curious question—has farming any influence upon climate? And it has been found that cultivation positively alters, and that to a very material extent, the climate of a district. Our knowledge upon this singular subject is as yet only in its infancy, but such as it is, we propose attempting an abstract of it in this short paper.

One of the most remarkable effects of cultivation upon the climate, or, at any rate, upon the atmosphere, is, that it renders it much healthier; and, in a particular manner, it banishes that great cause of a high mortality—the ague. East Lothian, for instance, used to be so affected with this scourge that the reapers of such corn crops as then were, were expected to be attacked by it as a matter of course. Since, however, it has been brought to its present high state of farming, the disease is never even seen. In like manner, in reading the biographies of our predecessors, whether in Scotland or England, some two or three centuries ago, we cannot fail to be struck with the number of deaths resulting from intermittent fever. With improved cultivation of the soil, the complaint may be said to have become almost unknown in our island.

Conversely, districts that have been tilled and pretty healthy, if more imperfectly cultivated, become very unhealthy. There is, for example, a district in Italy called the Maremma, so pestiferous as to be unsafe to inhabit even for a very short time, which yet was once tolerably healthy. Some three centuries ago, however, it was depopulated by a plague, the soil went out of culture, and the consequence has been the extreme unhealthiness that has ever since prevailed. Similar instances might be brought forward, all tending to prove that, if a tract of land disposed to be malarious go out of culture, the malaria increases in intensity; and if, on the other hand, its culture be extended, the malaria is either rendered much milder, or altogether banished.

Malaria was long thought to arise from vegetable matter putrifying in stagnant water, and the good effects of culture were considered to be owing to the draining. It is now known, however,

that malaria does not exactly arise in this manner; and, moreover, this theory does not account for these healthy districts, when uncultivated, becoming pestiferous.

In like manner, it is extremely probable that cultivation renders the climate much more salubrious for cattle. The ravages committed by disease among cattle and sheep seem to have been formerly much greater in this country than they now are.

The effect of draining, indeed, in altering the temperature, and the flow of water in the rivers of those districts where it has been effectually performed, is very great. In an undrained district, a constant evaporation is going on, the effect of which is to keep the surface always cold; and the crops upon such a chilled surface are never, in an ordinary season, large ones. The effect of draining upon the quantity of water in rivers varies according to the surface. In a level district, the water in undrained land remains constantly in it as in a sponge, and, if a heavy fall of rain come, runs off it in turbid streams. The result of draining in such is to render the supply of water that finds its way into the rivers more equable. But in hilly districts, such as the pastoral parts of Scotland, the very reverse is the case, and any rain that descends finds its way down the steep drains to the valley with such rapidity as, when it is considerable, to produce floods.

But although the climate may by culture become more wholesome, and by drainage warmer, the great influence which agriculture has upon the climate of a country is by substituting crops for natural wood. The nature of this influence has been investigated by Boussingault; and we cannot, we think, do better than give an abstract of his essay upon the subject.

The common opinion is, that in those districts where the wood has been cleared away, the springs have tended to dry up, and the rivers to diminish; and these have unquestionably been two results produced by clearing and cropping. But, on the other hand, it has been noticed that, in such districts, the rivers which seem to have lost their regular supplies are subject to such extraordinary risings and floodings, as, perhaps, compensate for the general loss; and in the same manner, springs that appear almost dried up occasionally give rise to perfect torrents. It may be, then, that the effect of culture is not to alter the annual flow of water, but to render it more irregular. The question which it is of importance to decide is, Do draining and cropping alter the mean annual fall of rain in a district?

In order to obtain a satisfactory answer to this, we must examine lakes. Lakes are, in fact, the natural gauges of the quantity of rain that falls upon the surface of the district, traversed by their tributary streams. According to the quantity of water that falls into them will be their mean levels; and if the mean annual fall of rain in a district diminish, the level of the lake watered by the streams of that district will infallibly shrink, and *vice versa*.

One of the most instructive lakes, in this respect, is that of Valencia, in the valley of Aragua in Venezuela. It was visited fifty-two years ago by the celebrated Humboldt. At the time of Humboldt's visit, the inhabitants were much struck with the gradual diminution that had clearly been going on for some years in its waters.* The town of Valencia, for instance, was once situated one mile and a quarter from its banks, while, in 1800, it was three miles and a quarter. Hillocks, on the plain some distance from the margin, still received the name of islands. Upon some of the islands, many yards above the existing level, fresh-water shells were to be found. A fortress, built only sixty years before upon an island, was seen situated upon a peninsula. In fact, the diminution of the lake was matter of notoriety, and was referred by the inhabitants to imaginary subterranean canals. Humboldt, on the other hand, when he beheld a densely-populated and well-cultivated country, attributed the falling of the water to the clearing and the culture. "Men," he remarked, "when they fell the trees on the crowns and slopes of the mountains, entail upon posterity a double calamity—the want of food and the scarcity of water."

Five-and-twenty years later, Boussingault visited the same district. He found the inhabitants no longer apprehensive that their lake would disappear; on the contrary, it had been regularly enlarging its boundaries. Cultivated fields near its margin were submerged, the peninsula had again become an island, and many of the adjoining proprietors were alarmed, lest their whole estates would be covered by its waters. The inhabitants supposed that the imaginary subterranean canals had got choked up. Boussingault saw the matter in a different light.

Venezuela was no longer a province of Spain; the ploughshares that formerly cultivated this fertile valley had been turned into swords; the slaves had sought manumission by enlisting as soldiers, agricultural labour had been suspended, and the rank vegetation of the tropics had again covered the surface with wood. Thus, cultivation first reduced the quantity of rain that fell in this district, and want of cultivation restored it.

Again, in New Granada, the village of Ubaté is at present situated near two lakes. Only seventy years ago, these two lakes were united together and formed one, and the older inhabitants recollect observing the gradual recession of the water, and the addition of field after field that had been submerged. In like manner do they recollect the gradual clearing of the woods that has taken place—a clearing, indeed, that is yet, although much less vigorously, going on; and accordingly, up to the present day, the gradual, although slower, recession of the water continues.

* We should, perhaps, observe that this lake has no communication with the sea, or with any other lake.

To the east of this village Ubaté, and in the same valley, is another lake, which rather curiously has been found to have precisely the same level with these two. Two hundred years ago, it was visited by the historian Piedrahita, who states that it was ten leagues long and three broad. At present, it is only a league and a half long and one broad. As Piedrahita is an author of great accuracy, the only explanation that can be given is, that the three lakes have, but two centuries ago, formed one, and that the land now lying under crop between the two was once the bed of this lake, ten leagues in length. At any rate, it is known that a village called Zimajaca, which was founded close to the bank of the water, is now a league distant; and that this lake has very much receded is matter of notoriety. And it happens that there are salt-works in the neighbourhood that require a considerable amount of fuel, to afford which, the adjacent country, formerly covered with oaks and myrtles, has been completely stripped.

On the other hand, in the same district, but so high above the level of the sea that there are no trees, there is another lake that was likewise visited by Piedrahita. It has retained its old dimensions. There has, in this instance, been no clearing, and no diminution of its size. Boussingault adduces, as a similar instance, the lake of Quilatoa. It, too, is 13,000 feet above the level of the sea, and the district around it never was wooded. It was visited by Condamine in 1738, and by Boussingault in 1831, and at this latter visit was found to retain its former dimensions.

Analogous evidence may be obtained from observation upon European lakes. So long ago as the end of last century, Saussure examined some of the Swiss lakes, and came to the conclusion that the three great lakes of Neufchâtel, Bienne, and Morat, were once one. The Lake of Geneva, too, since its banks have been occupied by civilised men, has been evidently diminishing in capacity; and part of the present city of Geneva is now built upon levels that have clearly been formed by the receding of the water. No one will deny that in this interval there has been extensive clearings of forest-lands in Switzerland.

As is remarked by Boussingault, although it is impossible to deny the fact that running streams are diminished in size by clearing the forests, and substituting for the growth of trees agricultural proceedings, yet it is not easy to decide as to whether the diminution depends upon a less quantity of rain falling in the cultivated country, or upon a greater amount of evaporation from the surface. A less active evaporation unquestionably goes on in land covered by wood than in cleared land. A traveller in a country, part of which is cleared and part not, finds, for example, the cleared part dry, and the roads in the wooded parts so wet from retained moisture as to be almost impassable. Indeed, in a country covered with wood, the only possible manner of keeping

the roads passable, is by making them about three hundred yards wide; or, in other words, by making partial clearings. And of this action of wood in repressing evaporation, and thereby increasing the amount of water discharged by springs, many other illustrations may be given.

For instance, upon the Island of Ascension there was a capital spring of water, situated at the base of a mountain covered with trees. These trees were cut down, and the consequence was that the spring almost dried up. The deficient supply of water was suspected to be owing to the clearing, and the mountain was again planted, and the result was, the spring in a little flowed with its usual abundance. It is extremely probable, indeed, that districts that suffer from drought in summer might escape this evil by means of judicious planting.

Again, Boussingault relates an instance of this kind that fell under his own notice. In the year 1826 he first visited the mines at Marmato in Popayan. The machinery of this establishment was turned by the water of a river fed by tributaries that flowed from the thickly-wooded table-land of San George. When he first visited the mines, Marmato consisted of a few wretched hovels inhabited by some slaves. Four years afterwards, when he quitted it, it was a large town, with foundries and workshops, and possessing a *free* population of three thousand souls. During this interval, a great quantity of wood had been required for building purposes and for fuel, not only for domestic purposes, but for the foundries. The timber growing on San George was most convenient to the townspeople, and, accordingly, they cut it down with an unsparing hand. In a little, the water in the river became so diminished as to excite apprehension that it would not be sufficient to turn the machinery, and its water was the only motive power present. This excited great alarm, and the river was regularly gauged, and, as long as Boussingault remained in the neighbourhood, it got less and less.

In the above instance, the natives of Marmato not unnaturally suspected that the mean annual quantity of rain was diminishing; they therefore erected a rain-gauge, but this indicated, the second year, when the river was regularly diminishing, a rather larger quantity of rain. However, although the diminished flow of water at Marmato must be ascribed, not to less rain, but to the clearing, Boussingault maintains that the extensive felling of forests does actually diminish the mean annual quantity of rain that falls in a district.

In support of this opinion, he refers to the fact that, in equinoctial countries, three different kinds of districts, with regard to rain, may be discriminated. Where there are forests and lakes, mountains and plains, the rainy season returns every year with astonishing regularity, and the dry and wet season can be calcu-

lated upon almost to a day. But if the whole district be covered with wood, the rainy season is always in excess, and sometimes almost perpetual. On the other hand, if the country be cleared, and agricultural operations carried on, the rain is diminished, and the inhabitants often suffer much from long droughts.

In like manner, in going south from the Panama, Boussingault found that as he passed through the provinces of Bonaventura, Choco, and Esmereldas, thick forests abounded, and that the rain was almost incessant. In Choco, in particular, it rained nearly every day. As he got a little farther south, the aspect of the country changed: there were no more forests, their place was taken by plains of sand, and it scarcely ever rained at all. The inhabitants at Payta assured him that it had not rained there for seventeen years. And yet the distance between Choco and Payta is not great, and the temperature and distance from mountains, &c. of the two places, are analogous.

We are, however, somewhat extending these desultory remarks, and we will conclude by transcribing the inferences that Boussingault thinks he is entitled to make from his observations. These are—

1. The clearing of wood, on a large scale, diminishes the quantity of running water in a country.
2. It is not possible to say whether this diminution of running water is owing to a less mean annual fall of rain, or to more active evaporation, or to both causes combined.
3. In the countries that have not been cleared and cultivated, no change in the quantity of running water has taken place.
4. Besides preserving running streams, by opposing evaporation, forests economise their flow.
5. That agriculture established in a dry country, where there are no trees, diminishes the flow of running water.
6. Clearings of forests, of limited extent, may cause the disappearance of particular springs when the mean annual fall of rain is not diminished.
7. In intertropical countries, extensive clearings *do* diminish the mean annual fall of rain.

QUANTITIES AND AVERAGE PRICES OF BRITISH CORN IN THE LONDON MARKET FOR EACH MONTH OF THE YEARS FROM 1846 TO 1851 INCLUSIVE. Compiled from the *London Gazette.*

Months and Years.	WHEAT.		BARLEY.		OATS.		RYE.		BEANS.		PEASE.	
	Quantity.	Price.	Quantity.	Price.	Quantity.	Price.	Quantity.	Price.	Quantity.	Price.	Quantity.	Price.
1846.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.
Jan. . .	21,784	3 2 2	19,127	1 12 8	50,068	1 3 7	159	1 17 11	3,906	1 16 6	3,232	2 1 4
Feb. . .	27,101	2 19 4	20,620	1 11 0	42,785	1 3 1	196	1 17 8	6,121	1 15 4	3,402	1 18 10
March . .	23,276	2 19 8	16,457	1 10 7	74,512	1 3 1	232	1 16 0	5,111	1 12 6	2,889	1 16 9
April . .	24,103	3 0 6	12,878	1 12 4	85,915	1 3 9	599	1 15 5	5,339	1 13 10	1,895	1 16 11
May . .	31,867	2 19 6	13,247	1 9 11	99,101	1 4 3	1,050	1 13 1	4,118	1 14 5	1,610	1 17 1
June . .	18,937	2 16 0	4,287	1 8 0	58,768	1 3 8	429	1 13 5	2,792	1 14 9	696	1 17 8
July . . .	14,064	2 16 3	2,476	1 7 6	35,863	1 3 3	171	1 14 7	1,750	1 17 10	540	1 17 8
August . .	19,088	2 10 10	2,295	1 7 4	35,624	1 2 10	369	1 12 8	2,082	1 19 9	823	1 19 10
Sept. . .	27,182	2 16 0	6,287	1 7 7	25,283	1 4 11	761	1 17 6	2,449	2 3 9	909	2 9 8
Oct. . .	36,198	3 3 11	17,138	2 1 6	41,168	1 7 3	1,198	1 19 1	4,960	2 4 8	2,869	2 17 2
Nov. . .	25,081	3 6 2	15,413	2 6 3	31,417	1 7 8	309	2 5 0	3,616	2 6 5	1,708	2 15 7
Dec. . .	33,708	3 4 11	19,554	2 5 4	31,581	1 7 11	603	2 4 7	4,566	2 5 0	1,678	2 14 4
1847.												
Jan. . .	28,887	3 13 2	11,406	2 14 3	36,364	1 11 5	215	2 10 9	4,857	2 9 8	1,873	2 15 11
Feb. . .	28,501	3 14 7	8,475	2 18 3	22,579	1 14 0	196	2 18 3	6,770	2 14 11	3,376	3 0 2
March . .	32,229	3 17 4	6,864	2 16 5	22,974	1 12 1	312	2 17 2	5,532	2 15 6	2,471	2 19 1
April . .	19,395	3 18 1	7,229	2 13 6	23,891	1 13 3	684	2 16 5	3,078	2 8 1	1,645	2 17 6
May . .	22,427	4 12 3	3,497	2 14 0	15,271	1 9 7	1,946	2 18 8	2,967	2 12 4	722	2 16 2
June . .	10,849	4 16 2	888	2 10 6	6,422	1 10 3	25	3 6 2	1,076	2 15 3	304	3 1 10
July . .	11,304	4 2 3	502	2 2 1	7,342	1 7 8	7	2 15 10	1,275	2 8 11	91	2 14 8
August . .	11,482	3 8 8	177	1 19 0	3,216	1 6 10	136	1 15 10	1,118	2 9 8	889	2 3 1
Sept. . .	15,197	2 14 7	2,044	1 14 4	3,753	1 5 3	117	1 16 8	1,271	2 1 3	1,015	2 4 2
Oct. . .	24,205	2 17 0	10,404	1 14 0	7,066	1 5 3	233	1 15 6	3,721	2 2 7	1,577	2 11 11
Nov. . .	21,943	2 15 9	12,950	1 13 8	14,578	1 4 5	74	1 14 4	2,164	2 1 8	1,139	2 10 11
Dec. . .	24,341	2 14 5	20,048	1 12 11	24,302	1 3 2	27	1 13 5	2,813	1 18 11	1,671	2 11 7
1848.												
Jan. . .	22,774	2 15 11	17,993	1 11 8	15,462	1 3 7	15	1 13 0	2,380	1 16 0	1,553	2 8 1
Feb. . .	20,977	2 13 4	12,478	1 12 3	29,170	1 3 0	29	1 11 0	3,673	1 16 5	2,105	2 5 8
March . .	17,612	2 11 7	14,051	1 11 6	43,327	1 1 1	76	1 10 4	3,420	1 14 2	2,645	2 0 9
April . .	19,307	2 12 10	11,230	1 13 0	33,686	1 0 0	110	1 8 10	3,194	1 12 8	1,255	1 17 5
May . .	14,878	2 11 8	4,385	1 13 0	23,927	1 0 3	...	...	1,740	1 13 7	287	1 16 8
June . .	17,063	2 9 5	797	1 13 6	17,051	1 1 10	...	...	1,298	1 14 8	366	1 19 2
July . .	24,698	2 11 7	447	1 9 1	15,963	1 0 10	64	1 9 1	1,106	1 13 6	383	1 17 9
August . .	27,218	2 14 7	98	1 10 10	6,290	1 2 2	48	1 10 9	983	1 12 6	867	1 18 0
Sept. . .	33,479	2 16 0	756	1 14 6	4,529	1 2 5	150	1 14 1	1,467	1 13 1	2,371	2 0 8
Oct. . .	18,108	2 12 11	6,261	1 12 10	4,035	1 1 3	136	1 13 2	3,864	1 13 9	2,070	2 1 9
Nov. . .	13,412	2 12 8	10,371	1 15 0	14,767	1 2 8	136	1 10 1	2,033	1 14 5	1,991	2 1 0
Dec. . .	13,954	2 9 11	12,006	1 13 1	24,533	1 0 6	76	1 7 0	2,124	1 10 10	2,178	2 0 7

QUANTITIES AND AVERAGE PRICES OF BRITISH CORN IN THE LONDON MARKET—*Continued.*

Months and Years.	WHEAT. Quantity.	WHEAT. Price.	BARLEY. Quantity.	BARLEY. Price.	OATS. Quantity.	OATS. Price.	RYE. Quantity.	RYE. Price.	BEANS. Quantity.	BEANS. Price.	PEASE. Quantity.	PEASE. Price.
1849.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.
Jan.	15,316	2 7 7	9,757	1 10 8	11,626	0 19 2	65	1 7 8	2,710	1 8 8	2,049	1 16 11
Feb.	14,601	2 8 3	10,542	1 10 5	32,988	0 18 3	64	1 6 10	3,790	1 8 5	2,427	1 13 10
March	10,743	2 6 4	9,587	1 9 8	31,698	0 17 4	124	1 4 2	3,185	1 7 1	1,776	1 12 11
April	7,590	2 7 5	3,602	1 10 0	12,863	0 18 6	77	1 3 6	2,171	1 5 0	730	1 9 1
May	10,731	2 7 10	2,566	1 11 1	11,412	0 18 10	518	1 4 0	1,351	1 7 4	467	1 10 1
June	11,473	2 6 0	840	1 8 7	16,964	0 19 3	211	1 4 0	1,572	1 9 4	308	1 10 5
July	9,153	2 9 7	113	1 4 0	7,862	1 0 5	38	1 4 8	540	1 11 11	67	1 12 0
Aug.	8,726	2 8 11	203	1 6 10	4,677	1 0 8	106	1 4 9	1,684	1 9 11	716	1 9 10
Sept.	16,704	2 5 9	1,429	1 10 9	7,006	0 19 11	66	1 4 0	1,306	1 8 6	1,885	1 12 5
Oct.	15,710	2 4 5	6,181	1 10 10	13,166	0 19 11	118	1 5 5	2,483	1 6 6	2,800	1 13 11
Nov.	14,163	2 3 10	7,371	1 10 5	11,713	0 18 5	329	1 3 4	1,631	1 8 11	2,625	1 12 8
Dec.	14,719	2 2 8	13,351	1 8 4	10,096	0 17 6	97	1 4 6	3,117	1 7 10	3,207	1 11 6
1850.												
Jan.	11,392	2 5 1	12,166	1 7 0	10,066	0 17 7	14	1 2 5	2,129	1 10 3	2,433	1 9 7
Feb.	13,653	2 2 5	8,251	1 5 8	15,315	0 17 0	8	1 3 0	4,098	1 5 2	2,456	1 7 4
March	15,031	2 2 3	12,248	1 5 4	25,571	0 16 6	93	1 1 10	4,951	1 4 11	2,582	1 5 11
April	11,204	2 2 10	4,381	1 3 7	9,340	0 16 5	94	1 2 0	2,622	1 3 0	1,016	1 6 0
May	14,615	2 1 8	3,201	1 3 3	4,404	0 15 8	86	1 1 10	1,566	1 4 6	551	1 5 7
June	15,734	2 3 7	728	1 4 10	2,396	0 18 5	288	1 3 0	1,684	1 6 4	485	1 8 0
July	8,737	2 4 7	244	1 4 0	3,615	0 19 0	12	1 4 9	888	1 6 0	211	1 6 7
Aug.	13,870	2 7 1	126	1 3 5	3,507	0 18 7	39	1 4 8	2,052	1 6 4	987	1 7 3
Sept.	15,324	2 6 8	641	1 6 10	3,028	0 17 4	58	1 8 0	771	1 9 0	1,042	1 11 3
Oct.	17,005	2 4 0	5,648	1 6 9	14,205	0 17 11	63	1 7 1	1,894	1 9 5	2,020	1 13 3
Nov.	16,875	2 3 4	14,327	1 7 0	39,398	0 18 1	54	1 5 1	2,049	1 9 2	1,976	1 10 9
Dec.	14,585	2 3 4	12,794	1 7 0	16,559	0 18 10	24	1 4 6	2,014	1 9 0	1,358	1 11 3
1851.												
Jan.	11,593	2 2 1	16,578	1 4 3	29,472	0 18 9	4	1 5 0	2,546	1 7 4	1,807	1 9 5
Feb.	8,820	2 1 4	9,023	1 4 11	40,260	0 17 2	9	1 3 8	2,796	1 5 3	1,873	1 9 1
March	10,675	2 1 1	12,093	1 3 10	34,232	0 17 1	63	1 3 3	3,772	1 5 1	1,556	1 5 10
April	10,276	2 3 0	5,623	1 5 10	24,975	0 17 7	189	1 4 5	1,806	1 4 9	764	1 5 1
May	11,263	2 1 8	2,106	1 4 11	13,271	0 19 1	107	1 4 4	1,231	1 6 1	598	1 5 9
June	11,149	2 3 7	1,302	1 4 9	12,450	1 0 1	11	1 5 0	901	1 10 0	330	1 6 9
July	9,161	2 5 1	373	1 5 0	8,925	1 1 8	25	1 7 5	1,203	1 9 3	220	1 8 2
Aug.	12,102	2 3 10	268	1 7 7	5,113	1 1 10	...	...	1,580	1 8 3	743	1 8 2
Sept.	20,749	2 1 4	1,072	1 9 0	4,294	1 0 1	71	1 7 5	1,056	1 8 0	972	1 10 4
Oct.	19,220	1 19 7	7,860	1 8 11	21,672	0 18 3	41	1 7 7	2,779	1 6 10	1,127	1 10 11
Nov.	20,647	1 19 8	12,268	1 9 1	44,020	0 18 7	94	1 8 0	1,606	1 9 2	2,543	1 11 4
Dec.	14,506	2 0 7	15,525	1 8 10	31,865	0 19 3	139	1 8 11	1,995	1 9 10	2,116	1 13 11

TOTAL QUANTITIES AND PRICE OF BRITISH CORN IN THE LONDON MARKET FOR EACH YEAR, FROM 1846 TO 1851 INCLUSIVE.

Years.	WHEAT. Quantity.	WHEAT. Price.	BARLEY. Quantity.	BARLEY. Price.	OATS. Quantity.	OATS. Price.	RYE. Quantity.	RYE. Price.	BEANS. Quantity.	BEANS. Price.	PEASE. Quantity.	PEASE. Price.
	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.	Qrs.	£ s. d.
1846	302,389	909,547 6 9	149,779	268,298 15 9	612,083	746,930 16 1	6,076	11,243 16 1	46,810	90,398 11 5	22,251	48,828 1 0
		3 0 0		1 15 9		1 4 4		1 17 0		1 18 7		2 3 10
1847	250,760	892,959 16 3	84,484	193,768 2 11	187,758	276,634 5 9	3,972	10,749 0 4	36,642	89,665 17 3	16,773	46,347 7 11
		3 11 2		2 5 9		1 9 5		2 14 1		2 8 11		2 14 11
1848	243,480	647,587 19 9	90,837	148,737 19 11	232,740	249,377 17 10	840	1,295 4 11	27,282	46,137 12 10	18,071	37,654 15 6
		2 13 2		1 12 8		1 1 5		1 10 10		1 13 9		2 1 7
1849	149,629	347,685 19 5	65,533	98,228 6 3	172,071	160,577 4 0	1,813	2,214 6 7	25,540	35,750 17 8	19,057	31,449 10 6
		2 6 3		1 9 11		0 18 7		1 4 5		1 7 11		1 13 0
1850	168,022	368,986 6 3	74,755	97,933 15 5	147,404	129,866 16 5	833	983 10 7	26,718	36,537 8 2	17,117	24,817 1 2
		2 3 11		1 6 2		0 17 7		1 3 7		1 7 4		1 8 11
1851	160,161	333,155 2 0	84,091	111,414 18 9	270,549	249,924 1 10	753	986 6 5	23,271	31,486 1 9	14,649	21,722 11 5
		2 1 7		1 6 5		0 18 5		1 6 2		1 7 0		1 9 7

ARRIVALS OF GRAIN INTO LONDON IN EACH YEAR, ENDING MICHAELMAS 1842 TO 1850 INCLUSIVE.

Year ending Michaelmas 1842.

	English.	Scotch.	Irish.	Foreign.	TOTAL.
Wheat, . qrs.	209,064	5,014	159	1,016,341	1,230,578
Barley, . –	266,607	16,082	259	41,743	324,691
Malt, . –	313,523	1,085	1,346	...	315,954
Oats, . –	217,332	105,536	584,386	219,748	1,127,002
Rye, . –	518	...	...	2,330	2,848
Beans, . –	50,439	69	...	46,261	96,769
Peas, . –	38,274	50	...	23,271	61,595
Tares, . –	3,044	71	...	26,346	29,461
Linseed, . –	454	50	151	110,846	111,501
Rapeseed, . –	601	...	5	9,188	9,794
Flour, { sacks,	299,168	160	2,262	43,861	345,451
Flour, { barrels,	...	...	...	113,293	113,293

Year ending Michaelmas 1843.

	English.	Scotch.	Irish.	Foreign.	TOTAL.
Wheat, . qrs.	274,593	3,351	897	439,998	718,839
Barley, . –	214,499	57,069	10,636	68,408	350,612
Malt, . –	321,585	3,661	868	...	326,114
Oats, . –	136,835	142,214	842,782	33,082	1,154,913
Rye, . –	1,806	25	30	...	1,861
Beans, . –	47,123	283	60	50,074	97,540
Peas, . –	24,132	43	...	7,592	31,767
Tares, . –	2,253	158	...	17,549	19,960
Linseed, . –	463	...	...	67,782	68,245
Rapeseed, . –	1,373	...	83	8,696	10,152
Flour, { sacks,	315,938	48	1,389	550	317,925
Flour, { barrels,	...	...	...	29,864	29,864

Year ending Michaelmas 1844.

	English.	Scotch.	Irish.	Foreign.	TOTAL.
Wheat, . qrs.	317,523	3,664	1,216	360,432	682,835
Barley, . –	194,811	44,415	17,655	351,761	608,642
Malt, . –	331,404	1,010	1,040	...	333,454
Oats, . –	93,032	107,906	849,802	204,048	1,254,788
Rye, . –	562	...	...	1,930	2,492
Beans, . –	57,983	823	20	44,259	103,085
Peas, . –	44,310	19	...	39,453	83,772
Tares, . –	3,954	550	...	17,839	22,343
Linseed, . –	406	...	60	151,022	151,488
Rapeseed, . –	565	...	736	18,537	19,838
Flour, { sacks,	327,653	...	1,144	155	328,952
Flour, { barrels,	...	...	...	73,236	73,236

[*Continued.*

ARRIVALS OF GRAIN INTO LONDON—*Continued.*

Year ending Michaelmas 1845.

		English.	Scotch.	Irish.	Foreign.	TOTAL.
Wheat,	qrs.	405,611	1,000	185	246,551	653,347
Barley,	–	177,300	34,528	3,977	226,687	442,492
Malt,	–	314,749	1,054	1,568	...	317,371
Oats,	–	59,924	117,638	728,391	412,114	1,318,067
Rye,	–	320	...	...	...	320
Beans,	–	52,930	91	...	42,105	95,126
Peas,	–	33,128	45	...	8,267	41,440
Tares,	–	1,712	90	...	26,359	28,161
Linseed,	–	163	...	100	214,590	214,853
Rapeseed,	–	285	...	751	13,509	14,545
Flour,	sacks,	322,366	...	1,768	2,145	326,279
	barrels,	...	...	...	36,396	36,396

Year ending Michaelmas 1846.

		English.	Scotch.	Irish.	Foreign.	TOTAL.
Wheat,	qrs.	289,369	602	374	598,587	888,905
Barley,	–	192,653	35,350	3,577	84,171	315,751
Malt,	–	289,470	925	2,894	...	293,289
Oats,	–	161,805	36,531	476,680	451,158	1,126,174
Rye,	–	685	60	...	...	745
Beans,	–	43,964	20	28	87,584	131,596
Peas,	–	41,369	274	...	37,854	79,497
Tares,	–	3,057	...	...	15,489	18,546
Linseed,	–	152	...	23	140,729	140,904
Rapeseed,	–	877	...	15	9,241	10,133
Flour,	sacks,	242,019	...	250	10,480	252,749
	barrels,	...	...	100	329,016	329,016

Year ending Michaelmas 1847.

		English.	Scotch.	Irish.	Foreign.	TOTAL.
Wheat,	qrs.	262,866	10,411	18,661	938,397	1,230,335
Barley,	–	114,947	27,471	5,473	401,402	549,293
Malt,	–	224,973	830	2,347	...	228,150
Oats,	–	78,967	25,136	132,469	957,916	1,194,488
Rye,	–	1,452	4	1,058	20,075	22,589
Beans,	–	35,246	18	5,810	119,251	160,325
Peas,	–	17,530	...	1,135	72,181	90,846
Indian corn,	–	...	...	118	130,143	130,261
Tares,	–	1,405	300	972	17,505	20,182
Linseed,	–	286	...	920	125,207	126,413
Rapeseed,	–	177	...	50	9,354	9,581
Flour,	sacks,	222,154	384	7,441	25,926	255,905
	barrels,	...	3,400	13,799	750,629	767,828

[*Continued.*

Arrivals of Grain into London—*Continued.*

Year ending Michaelmas 1848.

	English.		Scotch.	Irish.	Foreign.	Total.
	Coastwise.	E. C. Rail.				
Wheat, . qrs.	247,767	66,322	320	2,159	701,061	1,017,629
Barley, . —	165,710	24,248	14,967	389	272,844	478,150
Malt, . —	238,856	243,883	927	2,744	...	486,410
Oats, . —	86,328	20,387	52,756	177,994	720,308	1,057,773
Rye, . —	183	...	26	...	5,179	5,388
Beans, . —	26,585	5,005	205	...	167,808	199,603
Peas, . —	18,096	4,224	370	352	55,758	78,800
Indian corn, —	...	...	...	...	14,512	14,512
Tares, . —	1,613	...	1,210	146	17,885	20,855
Lentils, . —	...	...	...	...	8,575	8,575
Linseed, . —	302	...	...	...	228,776	229,079
Rapeseed, —	40	...	...	...	7,841	7,883
Flour, sacks,	184,034	312,565	...	200	21,764	518,563
Flour, barrels,	...	...	...	50	62,734	62,784

Year ending Michaelmas 1849.

Wheat, . qrs.	132,169	26,841	171	...	1,040,472	1,199,653
Barley, . —	113,547	13,954	12,923	210	514,694	655,328
Malt, . —	209,262	246,968	888	2,499	...	459,617
Oats, . —	73,245	11,407	93,123	92,561	1,006,460	1,276,796
Rye, . —	199	...	47	...	51,676	51,922
Beans, . —	29,345	5,563	85	...	94,356	129,349
Peas, . —	22,814	4,233	18	17	100,027	127,109
Indian corn, —	...	...	...	...	19,667	19,667
Tares, . —	3,216	...	150	184	36,868	40,418
Lentils, . —	...	...	...	...	4,193	4,193
Linseed, . —	264	...	...	...	157,535	157,799
Rapeseed, —	121	...	...	...	11,857	11,978
Flour, sacks,	167,161	295,890	...	40	186,218	649,309
Flour, barrels,	...	...	...	250	102,878	103,128

Year ending Michaelmas 1850.

Wheat, . qrs.	145,173	40,943	873	45	716,313	903,347
Barley, . —	103,961	8,958	15,366	15	429,744	558,044
Malt, . —	230,378	262,828	900	3,125	...	497,231
Oats, . —	75,447	32,014	66,587	64,998	1,043,584	1,282,636
Rye, . —	53	...	16	...	1,360	1,429
Beans, . —	32,340	9,627	219	79	70,732	112,097
Peas, . —	23,940	3,476	160	122	54,372	82,070
Indian corn, —	...	...	...	...	4,390	4,390
Tares, . —	3,282	...	190	169	16,983	20,624
Lentils, . —	...	...	...	...	4,440	4,440
Linseed, . —	33	...	...	28	92,919	92,980
Flax-seed, —	20	...	...	75	...	95
Rapeseed, —	917	...	...	50	17,338	18,305
Flour, sacks,	193,717	280,563	...	386	201,833	395,936
Flour, barrels,	...	...	...	200	60,368	60,568

NUMBERS OF CATTLE, SHEEP, CALVES, AND PIGS SOLD IN SMITHFIELD MARKET IN EACH MONTH OF THE YEARS FROM 1841 TO 1851, WITH THE LOWEST AND HIGHEST WEEKLY PRICES.

Year and Month	Cattle			Price per 8 lb		Sheep and Lambs			Price per 8 lb		Lamb per 8 lb	Calves			Price per 8 lb		Pigs			Price per 8 lb	
	Home number	Foreign number	Total number	Lowest	Highest	Home number	Foreign number	Total number	Lowest	Highest	Monthly average	Home number	Foreign number	Total number	Lowest	Highest	Home number	Foreign number	Total number	Lowest	Highest
				s. d.	s. d.				s. d.	s. d.	s. d.				s. d.	s. d.				s. d.	s. d.
1841.																					
Jan.	..	..	11,923	3 3¼	4 11	..	..	90,290	3 8½	4 10¾	..	..	..	749	5 3	5 1	..	..	3,569	4 4½	4 10
Feb.	..	..	12,145	3 2½	4 9½	..	..	81,710	3 8	5 1	6 0	..	..	635	5 1¾	5 9	..	..	3,456	4 4	4 10
March	..	..	14,905	3 5½	4 9¾	..	..	94,660	3 11½	5 4¼	6 0¼	..	..	929	5 2	5 7½	..	..	4,193	4 4	4 10
April	..	..	13,118	3 6½	4 9¼	..	..	110,630	3 7	5 1	6 3¾	..	..	1,008	5 2	5 8	..	..	4,555	4 4¼	4 11
May	..	..	15,906	3 1½	4 5¾	..	..	145,560	3 5¾	4 10	5 7	..	..	1,458	5 2	5 7	..	..	4,846	4 3	4 9
June	..	..	12,060	3 4¼	4 8½	..	..	160,610	3 5	4 10	5 6	..	..	1,955	4 7¾	5 4	..	..	4,495	4 3	4 9
July	..	..	13,074	3 5¾	4 8½	..	..	144,660	3 5	4 10	5 0	..	..	1,690	4 8½	4 11½	..	..	4,744	4 3	4 8¾
Aug.	..	..	17,162	3 5	4 7	..	..	163,840	3 5½	4 8¾	4 10	..	..	1,773	4 4¼	5 0	..	..	5,045	4 3	4 9
Sept.	..	..	15,218	3 5¼	4 7¼	..	..	122,490	3 3¾	4 9½	4 4	..	..	1,895	4 8¼	5 9	..	..	4,147	4 7¼	4 11½
Oct.	..	..	16,867	3 5¼	4 5¼	..	..	116,650	3 5¾	4 10¾	..	..	..	1,068	4 9	5 3	..	..	4,096	4 10	4 10
Nov.	..	..	18,927	3 5¼	4 4	..	..	115,210	3 5½	4 9¾	..	..	..	1,297	4 9¾	5 2½	..	..	4,980	4 10¼	5 2¼
Dec.	..	..	15,479	3 4¼	4 3	..	..	85,740	3 5¾	4 10¾	..	..	..	879	5 0	5 7½	..	..	3,674	4 9¾	5 3
1842.																					
Jan.	15,932	..	15,932	3 7	5 7	120,660	..	120,660	3 7	4 10	..	851	..	851	4 7¼	5 1¾	3,300	..	3,300	4 9	5 1½
Feb.	13,639	..	13,639	3 5¾	4 4¼	86,998	..	86,998	3 8½	4 10¼	..	667	..	667	5 3½	5 9¾	3,012	..	3,012	4 8	5 0¾
March	14,151	..	14,151	3 4	4 3½	97,800	..	97,800	3 5	4 10	6 6¾	1,008	..	1,008	4 11¼	5 6	3,331	..	3,331	4 8	5 0½
April	15,327	..	15,327	3 3¾	4 3	126,890	..	126,890	3 5½	4 9¼	5 5¾	975	..	975	4 7¾	5 4½	3,157	..	3,157	4 7¼	5 0
May	16,117	..	16,117	3 3	4 3¼	151,630	..	151,630	3 8	4 4¼	5 7	1,746	..	1,746	4 3¼	5 3½	3,600	..	3,600	4 4	4 9
June	11,433	..	11,433	3 3½	4 8	156,970	..	156,970	3 5¼	4 3	5 6	3,201	..	3,201	4 0¼	4 7¼	3,038	..	3,038	4 3	4 10
July	13,173	50	13,223	3 4	4 5½	176,144	6	176,150	3 5	4 3½	6 2	2,753	8	2,761	3 9¾	3 11¾	2,575	20	2,595	4 2¾	4 6¾
Aug.	17,483	396	17,889	3 3	4 3¼	191,516	114	191,630	3 6½	4 4	4 10	2,540	10	2,550	3 9¾	4 3½	2,809	54	2,863	4 6½	4 9
Sept.	17,034	678	17,712	3 5½	4 3¾	152,140	170	152,310	3 6	4 5½	4 5¾	2,121	8	2,129	4 1½	4 8¼	3,367	54	3,421	4 3	4 10
Oct.	21,758	498	22,256	3 1	4 1¾	158,170	20	158,090	3 3½	4 4	4 8	1,401	27	1,428	3 5¾	4 3½	5,038	24	5,062	4 3	4 10
Nov.	16,170	363	16,533	2 11½	..	119,717	13	119,730	3 1	4 3¼	..	2,103	2	2,105	3 2¾	4 4	3,412	36	3,448	4 2	4 7¾
Dec.	16,672	111	16,783	3 1	4 3	106,440	..	106,440	3 3½	4 0¾	..	1,309	..	1,309	3 11	4 5	2,708	17	2,725	4 1	5 5¾
1843.																					
Jan.	13,370	66	13,436	3 1	4 4	102,334	6	102,340	3 3½	4 3	..	916	..	916	4 1	4 6¾	3,371	25	3,396	4 1	4 7
Feb.	12,589	4	12,593	2 11½	4 1¼	92,618	2	92,620	3 0½	3 11¾	..	919	..	919	4 2½	4 7¾	2,665	9	2,674	3 8¼	4 3
March	14,793	86	14,879	2 5	3 10½	121,396	4	121,400	2 10	3 7¼	5 5	1,339	1	788	3 11½	4 5¼	3,465	14	3,479	3 4	3 9¼
April	12,353	81	12,434	2 7½	3 11¼	121,818	2	121,820	3 0	4 0¼	5 5½	1,503	1	1,340	4 1¼	4 7¾	2,814	8	2,822	3 5	3 10
May	12,371	23	12,394	2 7	3 9¾	132,527	23	132,550	2 11½	3 9½	4 11¾	2,260	3	1,506	3 8¾	4 4¼	2,662	17	2,679	3 3	3 9¾
June	15,222	31	15,253	2 6¾	3 10½	185,400	10	185,410	3 2	4 1	4 10½	3,025	4	2,264	3 8	4 3	3,219	4	3,223	3 4	3 10¼
July	11,805	78	11,883	2 11¼	3 5¾	148,016	14	148,030	3 3½	4 2¼	4 6	2,083	6	3,031	3 10½	4 5½	3,003	23	3,026	3 4½	3 10½
Aug.	13,142	47	13,189	2 9½	3 11	149,639	21	149,660	3 0½	4 2	4 2	2,317	2	2,085	3 10¼	4 4¼	2,869	22	2,891	3 3	3 10
Sept.	18,385	144	18,529	2 7	3 9¾	179,001	9	179,010	2 11¼	4 2¼	4 2	2,317	2	2,319	3 10¼	4 5½	2,555	24	2,579	3 8½	4 3
Oct.	16,662	127	16,789	2 8¼	3 9	120,542	8	120,550	2 10½	4 1	..	1,369	1	1,370	3 7½	4 2½	3,333	15	3,348	3 2½	3 9¾
Nov.	15,582	14	15,596	2 8½	3 9½	103,885	5	103,890	2 11½	4 2¼	..	1,255	1	1,256	3 2¾	3 9½	3,602	11	3,613	3 3	3 9½
Dec.	18,114	44	18,158	2 11	3 8	114,474	6	14,180	3 1½	4 5	..	1,318	1	1,319	3 7¾	4 3¾	2,530	11	2,541	3 3	3 11½

[*Continued.*

NUMBERS OF CATTLE, SHEEP, CALVES, AND PIGS SOLD IN SMITHFIELD MARKET—*Continued.*

Year and Month	Cattle: Home number	Cattle: Foreign number	Cattle: Total number	Price per 8 lb: Lowest	Price per 8 lb: Highest	Sheep and Lambs: Home number	Sheep and Lambs: Foreign number	Sheep and Lambs: Total number	Price per 8 lb: Lowest	Price per 8 lb: Highest	Lamb per 8 lb: Monthly average	Calves: Home number	Calves: Foreign number	Calves: Total number	Price per 8 lb: Lowest	Price per 8 lb: Highest	Pigs: Home number	Pigs: Foreign number	Pigs: Total number	Price per 8 lb: Lowest	Price per 8 lb: Highest
				s. d.	s. d.				s. d.	s. d.	s. d.				s. d.	s. d.				s. d.	s. d.
1844.																					
Jan.	15,683	6	15,689	3 0	4 2	101,008	2	101,010	3 3½	4 3¾	..	918	..	918	4 1	4 5	2,831	6	2,837	3 4½	4 1½
Feb.	12,227	21	12,248	2 7¼	3 8	93,045	5	93,050	2 11	4 6	..	782	..	782	3 11¾	4 7½	2,649	4	2,653	3 3½	3 10½
March	13,188	64	13,252	2 6¾	3 10½	117,908	2	117,910	2 11¼	4 4	5 6	1,035	1	1,036	4 1½	4 8½	2,741	7	2,748	3 3¼	3 11¼
April	14,841	52	14,893	2 5½	3 9½	138,530	20	138,550	2 10	4 0	5 8½	1,072	2	1,074	3 7¾	4 9½	3,094	13	3,107	3 4½	4 0
May	13,589	115	13,704	2 6¼	3 9½	150,482	8	150,490	2 10¾	3 9	5 5¼	1,562	7	1,569	3 9	4 5½	3,505	5	3,510	3 4¾	4 1¾
June	12,404	202	12,606	2 6	3 8½	154,271	19	154,290	2 10¼	3 10	4 9	2,965	9	2,974	3 7¾	4 2½	2,942	24	2,966	3 3¾	3 10¾
July	15,156	225	15,381	2 7	3 10½	154,978	32	155,010	2 10¼	3 11	4 6	2,578	..	2,578	3 6¼	4 1¾	2,978	31	3,009	3 3	3 10¼
Aug.	15,107	311	15,418	2 8¼	3 10½	192,967	93	193,060	2 11½	3 11	4 2½	2,686	2	2,688	3 8	4 1½	2,589	5	2,594	3 3	3 9¾
Sept.	19,252	489	19,741	2 7¼	3 9¾	139,658	182	139,840	2 10½	3 11	4 2½	1,705	8	1,713	3 7¾	4 2¾	3,174	17	3,191	3 2¾	3 7¾
Oct.	13,741	389	14,130	2 6¼	3 11½	124,097	283	124,380	2 9	2 11	..	1,445	..	1,445	..	4 2½	3,140	11	3,151	3 3	3 7½
Nov.	20,447	524	20,971	2 5¾	3 10¾	139,713	707	140,420	2 10	3 10½	..	1,423	..	1,423	3 3	3 10	3,258	9	3,267	3 3	3 9¼
Dec.	18,122	36	18,158	2 9¾	4 3	101,062	58	101,120	2 11¾	4 2	..	811	..	811	3 5¾	4 1	3,195	7	3,202	3 3	3 9¾
1845.																					
Jan.	16,479	142	16,621	2 9	4 2	119,320	200	119,520	2 11	4 3¼	..	807	..	807	2 10¼	4 6	2,987	..	2,987	3 6¼	4 5
Feb.	13,996	428	14,424	2 8	3 11¼	102,469	511	102,980	2 10½	4 11	..	1,018	..	1,018	4 4¾	5 0¾	2,539	6	2,545	3 7¼	4 10
March	13,668	275	13,943	2 7	3 10¼	95,009	161	95,170	2 11½	4 8	..	760	20	780	4 8	4 9¾	2,861	5	2,866	3 4¾	4 4
April	13,465	440	13,905	2 7½	3 11¼	114,960	100	115,060	3 3	4 4	5 5	1,104	35	1,139	4 9¼	4 4	2,517	25	2,542	3 4	3 11
May	17,083	438	17,521	3 1	4 3¼	146,972	158	147,130	3 7¾	4 10	5 5¾	1,896	15	1,911	4 5	4 8¼	2,761	40	2,801	3 4	3 10¼
June	12,285	640	12,925	3 3	4 4	125,990	300	126,290	3 9	4 9	5 4½	2,370	40	2,419	4 7	4 11¾	2,610	39	2,645	3 7	4 1
July	11,746	630	12,376	3 1¼	4 3½	134,330	130	134,460	3 5	4 11	5 6	2,588	49	2,637	4 11¾	4 7¾	2,754	70	2,824	3 4	4 7
Aug.	17,836	715	18,551	3 0	4 2	156,477	1,323	157,800	3 7	4 11	5 3¼	2,681	111	2,792	3 10¾	3 7½	2,450	75	2,525	3 4	4 0¼
Sept.	15,941	885	16,826	2 6½	4 9¼	120,659	1,611	122,270	3 2¾	4 7½	4 6	1,743	75	1,818	4 1	4 8½	2,665	50	2,715	3 6	4 1
Oct.	21,319	629	21,948	2 5	4 2	131,752	1,628	133,380	3 10	5 1	..	1,342	27	1,369	4 2½	4 10	2,774	105	2,879	4 2	4 11
Nov.	16,149	761	16,910	2 9	4 1	100,297	1,533	101,830	3 2	4 8	..	1,339	8	1,347	4 6	5 2	2,679	40	2,719	4 6	5 0
Dec.	14,720	2,210	16,930	3 1	4 3	82,811	3,329	86,140	3 9	5 1	..	718	2	720	4 3	4 11	2,620	89	2,709	4 2	4 11
1846.																					
Jan.	12,804	1,460	14,264	2 7	4 1	84,960	2,300	87,260	3 11½	5 2	6 10	863	14	877	4 2½	5 2	2,574	70	2,644	3 9	5 0
Feb.	12,002	1,094	13,096	2 11	4 2	73,147	1,693	74,840	4 0½	5 5	7 0	682	20	702	4 4	5 2	2,151	22	2,173	4 2	5 1
March	15,066	749	15,815	2 5	3 10	89,825	925	90,750	3 4	4 5	5 7	811	10	821	4 1	4 9	2,351	10	2,361	4 1	4 9
April	12,802	707	13,509	2 8	4 1	85,989	1,201	87,190	3 6	5 2	6 8	923	8	931	4 10	..	2,713	25	2,738	..	4 6½
May	12,982	957	13,939	2 7	4 1	122,561	999	123,560	3 4	4 2	..	1,629	10	1,639	4 2	4 10	2,307	23	2,330	4 1	4 10
June	14,128	791	14,919	2 5	3 9	176,489	2,911	179,400	3 1	4 3	..	3,414	32	3,446	3 7	4 4	2,538	83	2,621	3 11	4 8
July	14,657	966	15,623	2 7	4 1	171,270	3,600	174,870	3 4	4 3	5 6	2,675	110	2,785	3 9	4 4	1,931	121	2,052	4 1	4 9
Aug.	18,382	1,625	20,007	2 9	4 0	180,014	8,756	188,770	3 7	4 7	4 11	2,550	219	2,769	3 9	4 4	1,635	295	1,930	4 1	4 9
Sept.	15,586	3,387	18,973	2 9	4 0	126,343	12,703	139,050	3 10	4 10	5 0	1,573	510	2,083	4 1	4 8	2,405	761	3,166	4 2	4 9
Oct.	17,549	2,485	20,034	3 0	4 1	104,352	6,768	111,120	4 3	5 4	..	1,491	218	1,709	4 0	4 8	4,032	188	4,220	4 3	4 9
Nov.	20,086	2,823	22,909	2 5	4 1	111,381	8,939	120,320	3 9	5 4	..	1,139	100	1,239	3 11	4 6	3,457	71	3,528	..	..
Dec.	15,257	1,530	16,787	3 0	4 3	75,860	5,830	81,690	3 9½	5 1	..	818	45	863	3 11	4 7	2,040	..	2,040	4 0	4 7

[*Continued.*

NUMBERS OF CATTLE, SHEEP, CALVES, AND PIGS SOLD IN SMITHFIELD MARKET—*Continued.*

Year and Month	Cattle			Price per 8 lb		Sheep and Lambs			Price per 8 lb		Lamb per 8 lb	Calves			Price per 8 lb		Pigs			Price per 8 lb	
	Home number	Foreign number	Total number	Lowest	Highest	Home number	Foreign number	Total number	Lowest	Highest	Monthly average	Home number	Foreign number	Total number	Lowest	Highest	Home number	Foreign number	Total number	Lowest	Highest
1847.				s. d.	s. d.				s. d.	s. d.	s. d.				s. d.	s. d.				s. d.	s. d.
Jan.	14,360	630	14,990	3 4½	4 3	80,996	4,514	85,510	3 11	5 0	..	995	..	995	4 6	4 11	1,987	3	1,990	4 2	4 10
Feb.	14,312	960	15,272	3 4	4 2	76,800	1,934	78,740	3 8	4 11	..	726	51	777	4 4½	5 2	2,277	8	2,285	4 1	4 9
March	16,957	1,499	18,452	2 9	4 0	97,425	1,645	99,070	3 8	5 1	..	496	414	910	4 7	5 2	2,562	8	2,570	4 1	4 9
April	15,188	2,884	18,072	3 3	4 4	102,666	2,684	105,350	4 0	5 4	6 2	1,148	255	1,403	4 8	5 2	3,081	9	3,090	4 4	5 4
May	18,897	654	19,551	3 7	4 8	124,012	3,548	127,560	4 4	5 10	5 10	1,575	499	2,074	4 9	5 3	3,227	20	3,247	3 10	4 8
June	13,100	1,319	14,419	4 4	5 6	123,350	16,200	139,550	4 6	5 7	6 6	2,884	220	3,104	4 7	5 2	2,238	100	2,338	4 2	4 10
July	12,671	3,304	15,975	3 10½	5 4	148,123	12,147	160,270	4 4	5 4	5 6	2,888	1,458	4,346	4 4	5 1	2,496	12	2,508	4 3	4 10
Aug.	17,993	4,185	22,178	3 9	5 4	160,507	19,363	179,870	4 2	5 2	5 6	1,947	1,942	3,889	4 4	4 10	2,393	47	2,440	4 2	4 8
Sept.	17,900	4,000	21,900	3 4	4 6	119,832	14,688	134,520	3 10	5 2	5 3	1,820	1,362	3,182	4 2	4 10	2,030	270	2,300	4 4	4 10
Oct.	17,565	3,233	20,798	3 3	4 10	120,186	14,254	116,440	3 8	5 0	..	1,864	450	2,314	4 4	5 0	2,865	218	3,083	4 3	5 0
Nov.	19,062	3,486	22,548	3 3	4 2	109,426	16,334	125,760	4 0	5 1	..	940	667	1,607	4 6	5 0	3,555	41	3,596	4 5	5 1
Dec.	14,702	1,969	16,671	3 6	4 11	76,987	8,653	85,640	3 11	..	..	725	406	1,131	4 6	5 2	2,472	223	2,695	4 4	5 0
1848.																					
Jan.	17,092	720	17,812	3 8	4 9	97,975	4,665	102,640	3 10	5 2	..	773	110	883	4 8	5 2	2,580	15	2,595	4 2	5 0
Feb.	14,091	852	14,943	3 8	4 8	70,089	1,181	71,270	4 2	5 6	..	787	103	890	4 10	5 4	1,861	4	1,865	4 2	5 0
March	14,271	1,646	15,917	3 5	4 4	70,540	2,341	78,890	3 11	5 4	..	1,428	114	1,542	4 7	5 0	2,507	77	2,584	4 3	4 10
April	12,539	2,456	14,995	3 3	4 4	78,201	2,479	80,680	3 9	5 3	6 4	1,126	466	1,592	4 3	4 10	2,613	10	2,623	4 3	4 10
May	16,742	2,197	18,939	3 0	3 11	127,621	4,809	132,430	4 0	5 0	6 6	1,866	898	2,764	4 3	4 10	3,135	24	3,159	4 8	5 0
June	15,303	2,044	17,347	2 10	3 10	138,025	9,665	147,690	4 0	4 11	5 11	2,745	1,692	4,437	3 8	4 4	2,866	95	2,961	4 0	4 7
July	18,282	1,666	19,948	3 0	4 0	157,893	9,007	166,900	4 2	5 2	4 10	2,826	1,706	4,532	3 10	4 6	2,559	31	2,590	4 1	4 8
Aug.	15,442	2,526	17,968	3 4	4 3	120,893	15,137	136,030	4 1	5 0	4 8	1,490	2,135	3,625	3 10	4 2	2,586	27	2,613	4 2	4 7
Sept.	16,860	4,301	21,161	3 2	4 1	108,529	21,681	130,210	3 6	5 4	..	1,823	1,625	3,448	3 11	4 4	3,378	155	3,533	4 2	5 0
Oct.	21,108	2,962	24,070	2 10	4 2	117,432	10,908	128,340	3 4	4 10	..	1,512	803	2,315	3 6	4 0	3,418	116	3,534	4 2	4 10
Nov.	15,863	3,488	19,351	3 0	4 4	80,509	13,501	94,010	3 2	4 10	..	689	669	1,358	3 8	4 2	2,170	156	2,326	4 1	4 8
Dec.	15,341	2,401	17,742	3 2	4 6	71,235	9,445	80,680	3 8	5 2	..	828	492	1,320	3 10	4 4	1,617	82	1,699	4 4	4 10
1849.																					
Jan.	17,891	547	18,438	2 10	3 10	94,293	3,767	98,060	3 2	4 10	..	876	180	1,056	4 4	4 10	1,374	1	1,375	3 10	4 6
Feb.	14,010	1,914	15,924	2 9	4 1	74,178	3,102	77,280	3 4	4 8	..	611	622	1,233	4 4	4 10	1,343	4	1,347	3 8	4 6
March	14,916	1,736	16,652	2 8	4 0	81,576	5,624	87,200	3 2	4 10	..	794	624	1,418	4 6	4 10	1,990	..	1,990	3 8	4 6
April	18,080	1,201	19,281	2 0	3 6	119,307	1,953	121,260	2 10	4 1	5 0	1,148	637	1,785	3 0	4 0	2,526	19	2,545	3 6	4 4
May	14,090	1,427	15,517	2 2	3 4	118,838	3,052	121,890	3 0	4 3	5 0	1,341	977	2,318	3 4	4 2	2,031	9	2,040	3 0	3 8
June	15,306	1,300	16,606	2 3	3 5	157,943	8,017	165,960	2 10	4 2	5 6	2,852	1,459	4,311	3 3	4 4	2,325	..	2,325	3 6	4 0
July	17,401	1,961	19,362	2 10	4 4	172,156	12,564	185,720	2 8	4 0	4 6	2,300	1,783	4,083	3 6	4 2	2,065	104	2,169	3 2	4 4
Aug.	15,294	2,913	18,207	2 10	4 4	153,480	16,160	169,640	3 2	4 0	4 4	2,268	1,000	3,268	3 2	3 11	1,823	302	2,125	3 8	4 6
Sept.	15,455	4,214	19,669	2 8	3 10	129,361	17,649	147,010	3 2	3 10	..	1,287	743	2,030	2 0	3 0	1,139	528	1,667	3 0	4 0
Oct.	19,437	5,008	24,445	2 8	3 11	124,670	16,190	140,860	3 2	4 1	..	1,248	565	1,813	3 2	4 2	1,994	243	2,237	3 2	4 2
Nov.	17,050	4,228	21,278	2 6	3 11	101,026	14,204	115,230	2 8	3 10	..	1,081	618	1,699	2 10	4 0	2,304	409	2,713	3 0	4 0
Dec.	15,739	2,442	18,181	3 0	4 4	71,209	12,811	84,020	3 4	4 4	..	421	987	1,408	3 4	4 4	2,052	128	2,180	3 6	4 4

[*Continued.*

NUMBERS OF CATTLE, SHEEP, CALVES, AND PIGS SOLD IN SMITHFIELD MARKET—*Continued.*

Year and Month	Cattle			Price per 8 lb		Sheep and Lambs			Price per 8 lb		Lamb per 8 lb	Calves			Price per 8 lb		Pigs			Price per 8 lb	
	Home number	Foreign number	Total number	Lowest	Highest	Home number	Foreign number	Total number	Lowest	Highest	Monthly average	Home number	Foreign number	Total number	Lowest	Highest	Home number	Foreign number	Total number	Lowest	Highest
1850.				s. d.	s. d.				s. d.	s. d.	s. d.									s. d.	s. d.
Jan.	14,866	687	15,553	3 0	3 10	93,399	2,161	95,560	2 11	4 2	..	644	370	1,014	3 7	4 6	1,773	10	1,783	3 6	4 0
Feb.	15,849	874	16,723	3 1	3 10	78,810	1,350	80,160	3 3	4 4	..	352	646	998	3 4	3 9	1,809	10	1,819	3 6	3 11
March	14,805	1,910	16,715	2 9	3 11	92,147	3,333	95,480	3 4	4 2	5 6	560	761	1,321	3 8	4 2	1,866	15	1,881	3 6	4 2
April	15,282	1,483	16,765	2 5	3 6	95,423	2,497	97,920	2 11	4 3	5 2	2,312	687	2,999	3 2	3 8	1,858	42	1,900	3 3	3 9
May	15,193	1,275	16,468	2 3	3 6	125,662	3,848	128,910	2 9	3 9	4 10	812	928	1,740	2 11	3 3	2,249	9	2,258	3 3	3 9
June	15,093	1,515	16,608	2 9	3 9	174,920	7,700	182,620	2 11	3 11	4 6	853	1,600	2,453	3 0	3 4	2,310	125	2,475	3 4	3 11
July	13,962	2,779	16,741	2 7	3 9	167,440	11,110	178,550	2 11	3 7	4 4	1,158	1,750	2,908	2 0	3 2	1,718	450	2,168	3 4	3 9
Aug.	15,113	4,277	19,390	2 9	3 7	161,744	19,746	181,490	3 1	4 0	4 6	403	1,945	2,348	2 11	3 6	1,710	581	2,291	3 2	3 9
Sept.	16,566	5,556	22,212	2 4	3 6	151,719	21,731	173,450	3 0	4 0	..	672	1,819	2,491	3 2	3 8	1,887	752	2,639	3 4	3 10
Oct.	16,167	5,939	22,106	2 4	3 8	119,278	20,952	140,230	3 0	3 10	..	808	1,312	2,120	2 10	3 6	1,913	1,702	3,615	3 2	4 0
Nov.	13,978	5,918	19,896	2 8	3 10	102,540	17,662	120,202	3 2	4 0	..	417	1,058	1,475	3 3	3 10	1,386	1,486	2,872	3 2	4 0
Dec.	20,518	3,721	24,239	3 4	4 0	85,151	14,793	99,944	3 2	4 2	..	334	1,530	1,864	3 4	3 10	2,228	391	2,619	3 4	4 0
1851.																					
Jan.	17,510	1,734	19,244	2 8	3 6	92,993	6,390	99,383	3 6	4 2	..	682	847	1,529	3 4	3 10	2,481	126	2,607	3 4	3 10
Feb.	15,781	2,020	17,801	2 8	3 6	81,150	5,980	87,130	3 8	4 4	5 9	513	941	1,454	3 4	3 10	2,370	75	2,445	3 4	3 10
March	18,059	2,367	20,426	2 8	3 6	100,584	7,210	107,794	3 8	4 6	5 6	639	760	1,399	3 6	3 10	2,808	167	2,975	3 6	3 10
April	15,450	1,467	16,917	2 8	3 6	111,180	4,510	115,690	3 4	4 4	5 6	802	976	1,778	3 4	3 10	2,659	231	2,990	3 4	3 8
May	18,082	2,738	20,820	2 6	3 7	144,900	7,670	152,570	2 10	4 2	5 6	1,427	1,756	3,183	2 11	4 0	3,858	142	4,000	2 10	4 0
June	18,826	2,171	20,997	2 7	3 7	191,850	16,150	208,000	2 6	3 10	5 0	2,058	2,110	4,167	2 11	3 11	3,415	386	3,801	2 8	3 8
July	14,433	4,207	18,640	2 6	3 6	174,038	20,202	194,240	2 8	3 11	4 10	1,826	1,886	3,712	2 7	3 8	2,727	293	3,020	2 0	3 8
Aug.	15,602	6,757	22,359	2 4	3 4	161,870	31,740	193,610	2 6	3 10	4 10	1,821	2,784	4,605	2 6	3 8	3,002	533	3,535	2 6	3 8
Sept.	19,173	10,410	29,583	2 4	3 4	160,670	35,360	196,030	2 8	3 11	4 6	1,215	2,418	3,633	2 6	3 8	2,909	1,833	4,742	2 7	3 9
Oct.	16,248	7,970	24,218	2 5	3 6	106,008	26,572	132,580	2 9	4 0	..	1,055	1,591	2,646	2 11	3 10	2,646	2,307	4,953	3 0	4 1
Nov.	16,645	7,715	24,360	2 6	3 9	93,730	26,130	119,860	3 0	4 2	..	532	1,495	2,027	3 0	4 0	3,022	938	3,960	3 1	4 6
Dec.	19,703	2,974	22,677	2 11	4 0	93,880	15,110	108,990	3 0	4 6	..	519	1,207	1,726	2 10	4 0	2,819	345	3,164	3 0	4 6
1841	176,778	..	176,778	3 4½	4 7½	1,432,030	..	1,432,030	3 6½	4 11	5 5½	15,336	..	15,336	4 11	5 5½	51,800	..	51,800	4 5½	4 10½
1842	188,889	2,096	191,095	3 4½	4 5½	1,644,975	323	1,645,298	3 5½	4 5¾	5 5	20,675	55	20,730	4 2	4 9¾	39,347	205	39,552	4 4¾	4 10¾
1843	174,388	745	175,133	2 8¾	3 10½	1,571,650	110	1,571,760	3 0½	4 1	4 9½	19,091	22	19,113	3 9¾	4 4½	36,088	183	36,271	3 5	3 11½
1844	183,757	2,434	186,191	2 7½	3 10¾	1,607,719	1,411	1,609,130	2 11	4 0½	5 0¼	18,982	29	19,011	3 8¼	4 3¾	36,096	139	36,235	3 3½	3 10½
1845	184,987	8,193	192,880	2 9¾	4 1½	1,431,046	10,984	1,442,930	3 4¼	4 9	5 3	18,375	382	18,757	4 1½	4 9¼	32,217	549	32,757	3 7¾	4 5
1846	181,301	18,574	199,857	2 8	4 0	1,402,191	56,629	1,458,820	3 7¾	4 10	5 11	18,568	1,296	19,864	4 0¾	4 8	30,134	1,669	31,803	4 0¾	4 9½
1847	192,707	28,119	220,826	3 5½	4 8	1,322,316	115,964	1,438,280	4 0	5 3	5 9½	18,008	7,724	25,732	4 5¼	5 0¾	31,183	959	32,142	4 2¼	4 10½
1848	192,934	27,259	220,193	3 2	4 3	1,238,951	104,819	1,343,770	3 9½	5 1½	5 5½	17,893	10,813	28,706	4 0¾	4 7	31,290	792	32,082	4 2¼	4 9¾
1849	194,669	28,891	223,560	2 7	3 10	1,339,037	115,093	1,514,130	3 0½	4 2¾	4 10¼	16,227	10,195	26,422	3 4¾	4 2½	22,966	1,747	24,713	3 4½	4 2¾
1850	187,482	35,934	223,416	2 8½	3 8¼	1,447,633	126,883	1,574,516	3 0¼	4 0	4 9¾	9,325	14,406	23,731	3 1	3 8	22,747	5,573	28,320	3 3¾	3 10¾
1851	205,512	52,530	258,042	2 6¾	3 6½	1,512,853	203,024	1,715,877	3 0	4 1¾	5 9½	13,088	18,771	31,859	2 11½	3 10	34,716	7,476	42,192	2 11¾	3 11

VARIATIONS IN THE SUPPLY OF THE NUMBERS OF CATTLE, SHEEP, CALVES, AND PIGS, IN SMITHFIELD MARKET IN 1851, WITH THE HIGHEST AND LOWEST PRICES.

Dates of Markets.	Days.	CATTLE.			PRICE PER 8 LB.		SHEEP AND LAMBS.			PRICE PER 8 LB.		LAMB PER 8 LB.		CALVES.			PRICE PER 8 LB.		PIGS.			PRICE PER 8 LB.		MILK COWS.
		Home number.	Foreign number.	Total number.	Lowest.	Highest.	Home number.	Foreign number.	Total number.	Lowest.	Highest.	Lowest.	Highest.	Home number.	Foreign number.	Total number.	Lowest.	Highest.	Home number.	Foreign number.	Total number.	Lowest.	Highest.	Number.
Jan. 1851.						s. d.				s. d.	s. d.	s. d.	s. d.				s. d.	s. d.				s. d.	s. d.	
Fri.	3	551	73	624	2 4	3 10	3,100	400	3,500	3 2	4 2	..	..	104	48	152	3 0	4 2	308	..	308	3 0	4 0	150
Mon.	6	3,796	286	4,082	2 2	3 8	20,873	1,560	22,433	3 0	4 4	..	..	44	116	160	3 0	4 2	286	24	310	3 0	4 0	..
Fri.	10	509	70	579	2 4	3 10	2,590	80	2,670	3 0	4 4	..	..	79	155	234	3 0	4 4	296	24	320	3 0	4 0	85
Mon.	13	3,591	358	3,949	2 4	3 10	18,180	890	19,070	2 10	4 4	..	..	39	61	100	3 2	4 6	295	..	295	3 0	4 0	..
Fri.	17	674	44	718	2 4	3 10	3,540	290	3,830	2 10	4 4	..	..	167	14	181	3 4	4 6	310	..	310	3 0	4 0	97
Mon.	20	3,961	366	4,327	2 6	3 10	19,570	1,100	20,670	3 0	4 4	..	..	37	82	119	3 8	4 8	262	23	285	3 0	4 0	..
Fri.	24	531	84	615	2 4	3 8	2,970	680	3,650	3 0	4 4	..	..	78	122	200	3 8	4 8	265	30	295	3 0	4 0	84
Mon.	27	3,358	405	3,763	2 4	3 8	19,430	1,210	20,640	3 0	4 4	..	..	44	100	144	3 6	4 10	268	12	280	3 0	4 0	..
Fri.	31	539	48	587	2 4	3 8	2,740	180	2,920	3 0	4 4	..	..	90	149	239	3 0	4 4	191	13	204	3 0	4 0	80
February.																								
Mon.	3	3,373	519	3,892	2 6	3 8	17,720	1,380	19,100	3 0	4 4	5 0	6 0	56	137	193	3 4	4 4	283	12	295	3 0	4 0	..
Fri.	7	552	49	601	2 4	3 6	2,790	280	3,070	3 0	4 4	5 0	6 0	72	172	244	3 4	4 4	210	20	230	3 0	4 0	80
Mon.	10	3,494	357	3,851	2 4	3 6	17,090	1,080	18,170	3 0	4 6	5 0	6 0	40	99	139	3 4	4 6	300	20	320	3 0	4 0	..
Fri.	14	611	148	759	2 4	3 6	2,570	470	3,040	3 0	4 6	5 0	6 0	81	133	214	3 4	4 4	282	13	295	3 0	4 0	84
Mon.	17	3,345	452	3,797	2 4	3 6	18,020	1,070	19,090	3 2	4 6	5 0	6 0	51	76	127	3 4	4 6	280	..	280	3 0	4 0	..
Fri.	21	567	60	627	2 4	5 6	2,430	310	2,740	3 4	4 6	5 0	6 0	70	140	210	3 4	4 6	288	7	295	3 0	4 0	74
Mon.	24	3,363	350	3,713	2 6	3 8	18,360	660	19,000	3 0	4 4	5 0	6 0	44	26	70	3 4	4 6	380	..	380	3 0	4 0	..
Fri.	28	476	85	561	2 6	3 8	2,170	750	2,920	3 0	4 4	5 0	6 0	99	158	257	3 4	4 6	347	3	350	3 0	4 0	85
March.																								
Mon.	3	2,996	351	3,347	2 6	3 8	17,880	900	18,780	3 2	4 6	5 0	6 0	40	116	156	3 4	4 6	340	10	350	3 0	4 0	..
Fri.	7	421	110	530	2 6	3 8	1,910	480	2,390	3 2	4 6	5 0	6 0	178	62	240	3 4	4 6	290	10	300	3 2	4 0	75
Mon.	10	3,365	414	3,779	2 4	3 8	17,920	1,250	19,170	3 2	4 6	5 0	6 0	46	85	131	3 0	4 2	342	8	350	3 2	4 0	..
Fri.	14	238	166	404	2 6	3 8	2,310	410	2,720	3 0	4 6	5 0	6 0	100	115	215	3 0	4 4	366	9	375	3 0	4 0	70
Mon.	17	3,165	429	3,594	2 6	3 8	17,710	1,110	18,820	3 0	4 6	5 0	6 0	49	71	120	3 0	4 0	256	24	280	2 10	4 0	..
Fri.	21	326	94	420	2 4	3 8	2,480	520	3,000	3 0	4 6	5 0	6 0	77	131	208	3 0	4 2	330	20	350	2 8	3 10	80
Mon.	24	3,307	385	3,692	2 8	3 8	17,110	1,160	18,270	3 0	4 8	5 0	6 0	58	61	119	3 0	4 4	270	40	310	2 8	3 10	..
Fri.	28	602	40	642	2 8	3 8	3,694	350	4,044	3 0	4 8	5 0	6 0	50	30	80	3 0	4 4	294	26	320	2 10	4 0	85
Mon.	31	3,639	378	4,017	2 6	3 8	19,570	1,030	20,600	3 0	4 8	5 0	6 0	41	89	130	3 0	4 4	320	20	340	3 0	4 0	..
April.																								
Fri.	4	331	69	400	2 4	3 8	3,540	480	4,020	3 2	4 8	5 0	6 0	153	51	204	3 2	4 4	341	9	350	2 10	3 10	..
Mon.	7	3,679	421	4,100	2 4	3 8	22,520	580	23,100	3 4	4 8	5 0	6 0	66	69	135	3 0	4 4	307	153	460	2 10	3 10	83
Fri.	11	328	80	408	2 4	3 8	4,140	420	4,560	3 2	4 6	5 0	6 0	40	101	141	2 10	4 2	380	..	380	2 10	3 10	..
Mon.	14	3,420	333	3,753	2 4	3 6	23,140	630	23,770	3 4	4 6	5 0	6 0	98	60	158	3 0	4 4	336	74	410	2 10	3 10	82
Fri.	18	492	93	585	2 4	3 6	8,110	270	8,380	3 4	4 6	5 0	5 10	185	266	451	3 0	4 2	200	..	200	2 10	3 10	..
Mon.	21	3,032	222	3,254	2 4	3 6	21,660	900	22,560	2 10	4 4	5 0	5 10	55	139	194	2 10	4 0	313	87	400	2 10	3 10	80
[illegible]	25	593	52	645	2 4	3 6	5,670	330	6,000	2 10	4 6	5 0	5 10	128	198	326	2 10	4 0	410	..	410	2 10	3 10	..
[illegible]n.	28	3,575	197	3,772	2 6	3 8	22,400	900	23,300	3 0	4 8	5 4	6 0	77	92	169	3 0	4 2	372	8	380	2 10	3 10	85

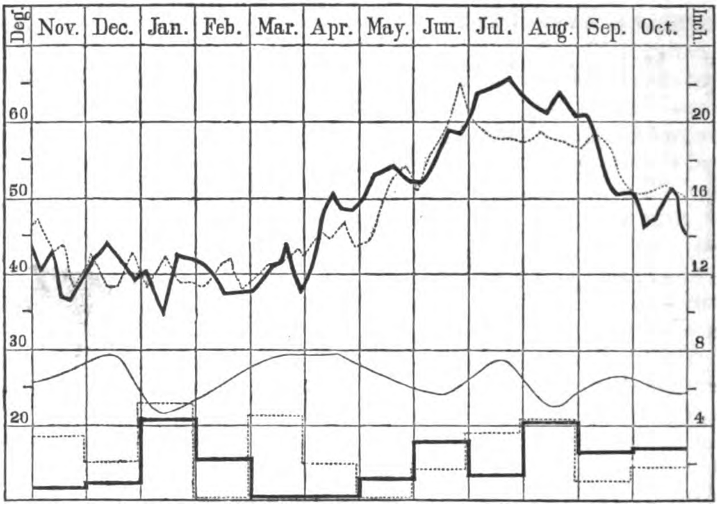
Dates of Markets.	Days.	CATTLE. Home number.	CATTLE. Foreign number.	CATTLE. Total number.	Price per 8 lb. Lowest. s. d.	Price per 8 lb. Highest. s. d.	SHEEP AND LAMBS. Home number.	SHEEP AND LAMBS. Foreign number.	SHEEP AND LAMBS. Total number.	Price per 8 lb. Lowest. s. d.	Price per 8 lb. Highest. s. d.	Lamb per 8 lb. Lowest. s. d.	Lamb per 8 lb. Highest. s. d.	CALVES. Home number.	CALVES. Foreign number.	CALVES. Total number.	Price per 8 lb. Lowest. s. d.	Price per 8 lb. Highest. s. d.	PIGS. Home number.	PIGS. Foreign number.	PIGS. Total number.	Price per 8 lb. Lowest. s. d.	Price per 8 lb. Highest. s. d.	MILK COWS. Number.
May 1851.																								
Fri.	2	834	247	1,081	2 6	3 8	8,570	160	8,730	3 0	4 6	5 0	5 10	183	301	484	3 0	4 4	407	3	410	2 10	4 0	104
Mon.	5	3,398	578	3,976	2 4	3 8	24,810	650	25,469	3 0	4 6	5 0	5 8	114	119	233	3 0	4 0	346	14	360	2 10	4 0	..
Fri.	9	850	53	903	2 4	3 6	8,790	420	9,210	3 0	4 4	5 0	5 8	180	191	371	3 0	4 0	395	..	395	2 10	4 0	89
Mon.	12	4,208	510	4,718	2 4	3 6	27,720	1,510	29,230	2 10	4 4	5 0	5 8	70	198	268	2 10	3 10	352	60	410	2 10	4 0	..
Fri.	16	826	98	924	2 4	3 6	6,940	750	7,690	2 10	4 2	5 0	5 8	190	231	421	2 10	3 10	410	..	410	2 10	4 0	107
Mon.	19	2,915	584	3,499	2 6	3 6	21,490	1,360	22,850	2 8	4 0	5 0	5 6	91	178	269	2 10	4 0	463	47	510	2 10	4 0	..
Fri.	23	965	185	1,150	2 6	3 8	10,220	550	10,770	2 8	4 0	5 0	5 6	230	176	406	2 8	4 0	520	..	520	2 10	4 0	114
Mon.	26	3,400	435	3,835	2 6	3 8	25,730	1,340	27,070	2 6	4 0	5 0	5 8	103	144	247	2 10	4 0	472	18	490	3 0	4 0	..
Fri.	30	686	48	734	2 6	3 8	10,630	930	11,560	2 6	4 0	5 0	5 8	266	218	484	3 0	4 0	495	..	495	3 0	4 0	108
June.																								
Mon.	2	3,279	203	3,482	2 6	3 6	29,470	2,070	31,540	2 6	4 0	5 0	5 6	131	208	339	3 0	4 0	440	40	480	2 10	3 10	..
Fri.	6	544	162	706	2 8	3 8	11,440	780	12,220	2 6	4 0	5 0	5 6	302	237	539	3 0	4 0	420	90	510	2 10	3 8	92
Mon.	9	3,529	303	3,832	2 8	3 8	27,840	1,050	28,890	2 6	3 10	5 0	5 6	118	139	257	3 0	4 0	139	..	139	2 8	3 8	..
Fri.	13	772	182	954	2 6	3 8	10,740	1,460	12,200	2 6	3 10	4 10	5 4	206	231	437	2 10	4 0	460	60	520	2 6	3 8	85
Mon.	16	3,418	360	3,778	2 6	3 8	27,450	2,230	29,680	2 6	3 10	4 10	5 4	140	188	328	3 0	4 0	373	54	427	2 6	3 8	..
Fri.	20	693	164	857	2 6	3 6	14,440	780	15,220	2 6	3 8	4 4	5 2	370	292	662	3 0	4 0	429	81	510	2 6	3 8	105
Mon.	23	3,155	363	3,518	2 6	3 6	30,150	2,930	33,080	2 6	3 8	4 2	5 2	145	296	441	2 10	3 10	344	41	385	2 6	3 8	..
Fri.	27	606	108	714	2 6	3 6	13,440	1,040	14,480	2 6	3 10	4 0	5 0	454	330	784	2 10	3 10	400	20	420	2 6	3 8	68
Mon.	30	2,830	326	3,156	2 6	3 6	26,880	3,810	30,690	2 6	3 10	4 0	5 0	191	189	380	2 10	3 10	410	..	410	3 6	3 8	..
July.																								
Fri.	4	801	105	906	2 6	3 6	13,808	1,052	14,860	2 8	4 0	4 4	5 0	441	252	693	2 10	3 10	380	15	395	2 6	3 8	75
Mon.	7	3,239	412	3,651	2 6	3 6	30,980	2,250	33,230	2 8	4 0	4 4	5 0	171	174	345	2 10	3 10	320	70	390	2 6	3 8	..
Fri.	11	637	326	963	2 6	3 6	14,890	990	15,880	2 6	3 10	4 4	5 0	547	167	714	2 8	3 10	375	10	385	2 6	3 8	98
Mon.	14	3,506	690	4,196	2 6	3 6	35,430	3,380	38,810	2 6	3 10	4 0	5 0	143	240	383	2 6	3 8	400	5	405	2 6	3 8	..
Fri.	18	257	423	680	2 6	3 4	12,050	1,950	14,000	2 8	3 10	4 0	4 10	196	233	429	2 6	3 8	312	38	350	2 6	3 8	113
Mon.	21	2,809	1,011	3,820	2 6	3 4	27,570	4,000	31,570	2 10	4 0	3 10	4 10	53	286	339	2 6	3 8	370	15	385	2 6	3 8	..
Fri.	25	324	170	494	2 4	3 4	10,580	2,220	12,800	2 10	4 0	3 10	4 10	148	348	496	2 6	3 6	260	40	300	2 6	3 8	132
Mon.	28	2,860	1,070	3,930	2 4	3 4	28,730	4,360	33,090	2 8	3 10	3 10	4 8	127	186	313	2 6	3 8	310	100	410	2 6	3 8	..
August.																								
Fri.	1	737	252	989	2 4	3 4	11,050	1,770	12,820	2 8	3 10	4 0	4 8	303	317	620	2 6	3 8	345	60	405	2 6	3 8	125
Mon.	4	3,033	1,154	4,187	2 4	3 4	27,760	4,050	31,810	2 8	3 10	4 0	4 8	124	314	438	2 6	3 8	315	100	415	2 6	3 8	..
Fri.	8	731	252	983	2 4	3 4	10,780	2,520	13,300	2 6	3 10	4 0	4 8	324	363	687	2 6	3 8	360	50	410	2 6	3 8	130
Mon.	11	3,113	1,096	4,209	2 4	3 4	27,100	5,900	33,000	2 6	3 10	4 0	4 8	150	265	415	2 6	3 8	345	65	410	2 6	3 8	..
Fri.	15	645	324	969	2 4	3 4	11,440	2,250	13,690	2 6	3 10	4 0	4 10	282	393	675	2 6	3 8	357	68	425	2 6	3 8	108
Mon.	18	3,043	1,224	4,267	2 4	3 4	27,480	5,450	32,930	2 6	3 10	4 0	4 10	126	236	362	2 6	3 8	310	70	380	2 6	3 8	..
Fri.	22	588	623	1,211	2 4	3 4	11,040	1,660	12,700	2 6	3 10	4 4	4 10	295	370	665	2 6	3 8	335	60	395	2 6	3 8	102
Mon.	25	3,273	1,369	4,642	2 4	3 4	26,060	5,500	31,560	2 6	3 10	4 4	4 10	117	266	383	2 6	3 6	365	30	395	2 6	3 8	..
Fri.	29	439	463	902	2 4	3 4	9,160	2,640	11,800	2 6	3 10	4 4	4 10	100	260	360	2 6	3 6	270	30	300	2 6	3 10	115

[*Continued*,

VARIATIONS IN THE SUPPLY OF THE NUMBERS OF CATTLE, SHEEP, CALVES, AND PIGS IN SMITHFIELD MARKET—*Continued.*

Dates of Markets.	Days.	CATTLE.			Price per 8 lb.		SHEEP AND LAMBS.			Price per 8 lb.		Lamb per 8 lb.		CALVES.			Price per 8 lb.		PIGS.			Price per 8 lb.		MILK COWS.
		Home number.	Foreign number.	Total number.	Lowest.	Highest.	Home number.	Foreign number.	Total number.	Lowest.	Highest.	Lowest.	Highest.	Home number.	Foreign number.	Total number.	Lowest.	Highest.	Home number.	Foreign number.	Total number.	Lowest.	Highest.	Number.
Sept. 1851.					s. d.	s. d.				s. d.	s. d.	s. d.	s. d.				s. d.	s. d.				s. d.	s. d.	
Mon.	1	3,379	1,300	4,679	2 4	3 4	28,490	4,770	33,260	2 8	3 10	4 4	4 10	102	233	335	2 6	3 8	355	30	385	2 6	3 10	..
Fri.	5	407	602	1,009	2 4	3 4	8,370	2,530	10,900	2 8	3 10	4 4	4 10	82	378	460	2 6	3 8	266	34	300	2 6	3 10	125
Mon.	8	3,270	1,380	4,650	2 4	3 4	26,100	5,170	31,270	2 8	4 0	4 2	4 8	89	216	305	2 6	3 8	370	220	590	2 6	3 8	..
Fri.	12	493	790	1,283	2 4	3 4	8,560	2,890	11,450	2 8	4 0	4 2	4 8	244	380	624	2 6	3 8	450	60	510	2 6	3 8	100
Mon.	15	3,357	1,730	5,087	2 4	3 4	29,420	4,770	34,190	2 8	3 10	4 0	4 8	105	175	280	2 6	3 8	320	290	610	2 6	3 8	..
Fri.	19	506	720	1,226	2 4	3 4	6,220	2,360	8,580	2 6	3 10	4 0	4 6	212	357	569	2 6	3 8	445	75	520	2 8	3 10	116
Mon.	22	3,852	1,418	5,270	2 4	3 4	25,830	6,290	32,120	2 6	3 10	4 0	4 4	93	176	269	2 6	3 8	302	560	862	2 6	3 8	..
Fri.	26	561	670	1,231	2 4	3 4	4,570	2,370	6,940	2 8	4 0	3 10	4 4	227	315	542	2 6	3 8	301	104	405	2 8	3 10	120
Mon.	29	3,348	1,800	5,148	2 4	3 4	23,110	4,210	27,320	2 10	4 0	3 0	4 2	61	188	249	2 6	3 8	100	460	560	2 10	4 0	..
October.																								
Fri.	3	599	623	1,222	2 4	3 4	4,400	2,390	6,790	3 0	4 0	..	..	168	227	395	2 8	3 10	140	320	460	3 0	4 0	113
Mon.	6	3,593	1,458	5,051	2 4	3 4	23,750	3,340	27,090	3 0	4 0	..	..	87	98	185	2 8	3 10	302	248	550	3 0	4 0	..
Fri.	10	613	649	1,262	2 4	3 4	4,090	1,420	5,510	3 0	4 0	..	..	171	125	296	2 10	3 10	290	200	490	3 0	4 0	126
Mon.	13	3,061	1,543	4,604	2 4	3 4	22,890	5,380	28,270	2 10	3 10	..	..	60	170	230	3 0	3 10	160	420	580	3 0	4 0	..
Fri.	17	554	166	720	2 6	3 6	3,030	890	3,920	2 8	4 0	..	..	152	170	322	3 0	3 10	200	310	510	3 0	4 0	130
Mon.	20	3,171	1,509	4,680	2 6	3 6	21,938	4,782	26,720	2 8	4 0	..	..	69	198	267	3 0	3 10	300	220	520	3 0	4 0	..
Fri.	24	537	415	952	2 6	3 8	2,860	810	3,670	2 8	4 0	..	..	173	218	391	3 0	3 10	405	248	653	3 0	4 2	125
Mon.	27	3,268	1,278	4,546	2 6	3 8	19,160	5,710	24,870	2 10	4 2	..	..	50	192	242	3 0	4 0	450	120	570	3 0	4 4	..
Fri.	31	852	329	1,181	2 6	3 8	3,890	1,850	5,740	3 0	4 2	..	..	125	193	318	3 0	4 0	399	223	620	3 0	4 6	132
November.																								
Mon.	3	3,839	1,612	5,451	2 6	3 8	20,690	4,680	25,370	3 0	4 2	..	..	50	168	218	3 0	4 0	380	130	510	3 2	4 8	..
Fri.	7	793	98	891	2 6	3 8	2,300	1,250	3,550	3 0	4 2	..	..	119	60	179	3 0	4 0	413	147	560	3 2	4 8	125
Mon.	10	3,498	1,784	5,282	2 6	3 8	21,220	5,560	26,780	3 0	4 2	..	..	24	340	364	3 0	4 0	399	111	510	3 2	4 8	..
Fri.	14	707	500	1,207	2 6	3 8	2,660	1,150	3,810	3 0	4 2	..	..	109	153	262	3 0	4 0	403	122	525	3 2	4 6	115
Mon.	17	3,162	1,643	4,805	2 6	3 8	19,000	5,060	24,060	3 0	4 4	..	..	53	247	300	3 0	4 0	375	105	480	3 0	4 6	..
Fri.	21	739	501	1,240	2 6	3 10	2,960	1,920	4,880	2 10	4 4	..	..	115	160	275	2 10	3 10	380	109	485	3 0	4 4	120
Mon.	24	3,378	1,390	4,768	2 6	3 10	22,550	5,340	27,890	2 10	4 2	..	..	48	179	227	2 10	3 10	351	109	460	3 0	4 4	..
Fri.	28	529	187	716	2 6	3 10	2,350	1,170	3,520	2 10	4 2	..	..	14	188	202	2 8	3 10	321	109	430	3 0	4 2	105
December.																								
Mon.	1	3,357	656	4,013	2 8	4 0	19,940	3,690	23,630	3 0	4 4	..	..	30	161	191	2 8	4 0	403	47	450	3 0	4 4	..
Fri.	5	802	95	897	2 8	4 0	2,520	1,820	4,340	3 0	4 4	..	..	69	88	157	2 8	4 0	350	30	380	2 0	4 4	110
Mon.	8	3,532	748	4,280	2 10	4 0	20,720	3,180	23,900	3 0	4 4	..	..	40	203	243	2 8	4 0	350	60	410	3 0	4 6	..
Fri.	12	1,473	240	1,713	3 0	4 0	2,570	350	2,920	3 0	4 4	..	..	51	194	245	2 8	4 0	210	70	280	3 0	4 6	110
Mon.	15	5,559	544	6,103	3 0	4 2	20,730	2,690	23,420	3 0	4 4	..	..	37	37	74	3 0	4 2	457	25	482	3 0	4 6	..
Fri.	19	1,209	112	1,321	3 0	4 2	3,020	380	3,400	3 0	4 4	..	..	140	189	329	3 0	4 4	337	25	362	3 0	4 6	118
Mon.	22	968	264	1,232	2 10	4 0	10,510	1,690	12,200	3 0	4 4	..	..	45	122	167	3 0	4 0	322	38	360	3 0	4 6	..
Fri.	26	163	109	272	2 10	4 0	470	120	590	3 0	4 4	..	..	62	44	106	3 0	4 0	180	20	200	3 0	4 6	120
Mon.	29	2,640	206	2,846	3 0	4 2	13,400	1,190	14,590	3 0	4 6	..	..	45	169	214	3 0	4 0	210	30	240	3 0	4 6	..

Thermometrographia for the Agricultural Year ending with October 1852. From observations at Annat Cottage, Perthshire; N. Lat. 56° 25′; Elevation, 170 feet.



The weekly mean temperature is indicated by the *upper* dark line, having reference to the scale of degrees at the left-hand side; the dotted line shows the weekly mean for the previous year. The scale of inches at the right-hand side refers to the *lower* dark line, showing the depths of rain in each month, with a dotted line for the monthly fall of rain in the preceding year. To provide a scale for the intermediate *waved* line, the line of 30 degrees may be called a line of 30 inches, and the space between it and the line below can then be divided into tenth parts of an inch.

The winter was comparatively mild, though not so mild as in 1850-51. June was cooler than in 1851, but in July and August there was an excess of heat, causing an unwontedly early harvest.

The mean temperature of the vegetating season, from March 20 to October 20, was 53.87 degrees; last year 52.96 degrees; average of last five years, 52.32 degrees.

The season has been still drier than that of 1849-50. The rain that fell in March and April was scarcely measurable, and November and December were remarkably dry. There was an excess of rain in January, and again in August. A full supply in June came providentially before the excessive heat of July. The depth of rain for the twelve months was 23.59 inches, and for the vegetating season 13.25 inches.

The mean temperature for the twelve months was 48.66 degrees; previous year, 48.22 degrees. The mean for the twelve months from November 1825 to October 1826 was as high as 49.11 degrees, and the rain in that period measured only 16.42 inches. The average of temperature in the spring and summer of 1826 and 1852 was nearly the same, but the difference in the supply of rain made the harvest of 1826 a failure, and of 1852 abundant. The summer of 1852 was too warm for the turnips of Scotland, sown, as they were, at a comparatively early period, to meet the character of the ordinary climate of Scotland. Hence the running to flower-stem, rapid maturation of the bulb, mildew in the dry weather of September, and absolute rottenness in many instances, which together have caused a deficiency in the turnip-fields of 1852; and a deficiency has also been found in the durability of their consumption.

Adaptation of each Variety of the Potato to a particular Soil. By GEORGE W. HAY, of Whiterigg, Melrose.—The following experiment was undertaken in 1852 at the suggestion of Mr Stephens, author of *The Book of the Farm*, in order to ascertain the length of the filaments which different varieties of potatoes extend previous to forming their tubers, with the view of discovering, if possible, the varieties best adapted for the different textures of soils; for it seems reasonable to expect that the varieties which shoot out the longest filaments should be planted in soils of the loosest texture, and that dense soils would obstruct the free growth of such varieties. To determine whether this idea is founded in truth, it will be necessary, next season, to plant the varieties possessing the longest filaments in both the densest and the loosest texture of soil, when the loosest soil ought to yield the larger crop. As to varieties with very short filaments, it does not apparently signify in what texture of soil they are planted.

While such an experiment was in hand, I determined on ascertaining the particulars contained in the annexed Table, besides the length of the filaments—which were the number of yards planted, and the produce obtained from the bushel of seed. It will be seen that 22 varieties were tried, in 24 lots, those of Lots 22 and 24 being planted of seed grown at home last year; and it is interesting to observe, in Lot 23, that the filaments from the new seed were much longer than from the seed which had been produced on the farm the year previous, showing, in some degree, the power of the plant to adapt itself to the nature of the soil. It may be remarked that the seed, in both cases, originally came from the same farm, the soil of which is of a light description. It will also be seen from the Table, that while the early varieties, of which there were 15, had their filaments varying in length, with two exceptions, from ½ an inch to 3 inches, the late ones, being 9 in number, had theirs varying, with three exceptions, from 3 to 8 inches. In an experiment like this, conducted only in one season, it is not to be expected that a just conclusion can be arrived at; and a course of years will even be required, assisted by accurate and varied experiments, before we can determine the congenial relation between varieties of the potato and texture of the soil. With the view of following out the experiment, and of ascertaining the effect of the soil upon the same sorts of plants in another year, the produce of each variety has been carefully preserved; and it is contemplated to arrange the varieties, according to the length of their filaments, beside each other, in different textures of soils, so as to ascertain as nearly as possible the prolificacy attending each length of filaments, in the texture of soil best suited to its habit.

The field in which this trial was made is a stiff clay on a retentive subsoil, which had been drained the previous autumn, and, of course, was scarcely fitted for such an experiment, although the

land had been thoroughly worked. All the varieties received the same treatment, the sets being cut and planted by the same parties; and a full proportion of farmyard manure was allowed, with an additional mixture of about 3 cwt. of guano, salt, and gypsum. The length of the filaments were measured when the plants were in full vigour of growth, in the beginning of August, and the crop was measured and weighed when it was lifted. In several instances the disease had prevailed to some extent, but not at all so injuriously as in the case of many of my neighbours. The drainage of the land being very recent, as well as the existence of disease, both tended to give a poor return; but the length or shortness of the filaments could not probably be much affected by such circumstances, and, at all events, all the varieties were under similar influences. I have marked the varieties unaffected by the disease, and all the others seemed to be affected with disease in about the same proportion. The unsound tubers were picked out previous to storing. I did not, however, intend to make the result known this year, but as the habit of growth of the potato in relation to the nature of the soil is not sufficiently attended to by farmers, I hope some one will take up the experiment fully in the coming season, and this has induced me to make this statement.

I am persuaded, were we to use even common precaution in assimilating the habits of our root plants to the texture of the soil, and to attend more to the selection of our seeds and roots, we would raise not only much larger crops, but of better quality; and were we also to follow the example of our gardening friends, we would collect seeds of all kinds only from the best-grown and most healthy plants, from soils similar to those in which we desire to raise our own crops. It is known to us all that good plants and flowers can only be propagated from good stocks and seeds, and yet we almost always act in a manner opposed to this known fact; for do we not use our sets of potatoes indiscriminately from the pits, cutting large and small together, and even taking sets from both ends of the tuber, although we well know that the crown gives us the best plants, while the end, attached by the filament to the parent stem, produces an almost worthless plant? Again, we almost invariably obtain seed for planting from a soil directly opposed in its nature to that which we are about to use, without reflecting upon the changes which a plant must undergo before it can accommodate itself to the new locality in which it is placed. We may observe in all instances, whether of grain or of root crops, that the second year's produce is invariably better than that after the first year's change, thereby indicating that the seed has become more assimilated to the nature of the new soil and climate. No doubt, if the same seed be continued for a length of time in the same locality, it will degenerate, unless proper care be taken to prevent its decay: but what I state is this—that plants intended for a stiff or a light soil ought to be

brought from a similar soil; and care should always be taken to provide plants and seed for a poor soil from one of better quality and better climate.

TABLE OF VARIETIES OF POTATOES, WITH THEIR LENGTHS OF FILAMENTS.

VARIETIES	Early and late in field and garden	Yards planted by a bushel of sets	Return in bushels from the bushel planted	Weight of produce		Length of filaments	Degree of disease
				st.	lb.		
1. July kidney	Early garden	992	about 2	9	10	3 inches	
2. Lawson's conjuror	Second early garden	992	,, 3	13	4	3 inches	
3. Ash-leaved	Early garden	928	,, 4	16	0	1½ to 2 inches	
4. Dwarf early frame	Earliest garden	976	,, 4	20	0	1 to 2 inches	Sound
5. Common frame	Earliest garden	1064	,, 4	18	4	1 to 2 inches	
6. Prince of Wales	Second early garden	896	,, 4	20	0	6 to 8 inches	Sound
7. Gold finders	Second early garden	992	,, 3	1	12	1 to 2 inches	
8. Manlie's early	Early garden	1016	,, 4	20	0	1 to 3 inches	
9. Java	Late field	816	,, 3	13	2	6 to 8 inches	
10. Jackson's kidney	Early garden	1000	,, 1	4	8	1 to 1½ inches	
11. Chapman's kidney	Early garden	1000	,, 3	10	4	3 to 6 inches	
12. Henk's kidney	Medium garden	640	{70 potatoes.}	—		½ an inch	
13. Fox's early globe	Earliest garden	976	fully 4	21	10	2 to 3 inches	
14. Williamson's early	Earliest garden	936	,, 3	12	0	½ to 1 inch	
15. Martin's early	Early garden	1008	about 3	10	4	½ to 1 inch	
16. London dwarf kidney	Earliest garden	736	,, 3	11	6	1 inch	
17. American dandy	Early field	736	,, 4	20	0	1 to 2 inches	
18. Scotch yam	Late field	784	,, 1½	7	10	½ to 1 inch	Sound
19. Ogilvie's red	Very late field	896	fully 4	20	0	1 to 3 inches	Sound
20. Perthshire red	Early field	1208	about 11	48	0	3 to 5 inches	
21. Orkney red	Very late field	864	fully 8	36	8	6 to 8 inches	Sound
22. Second American	Early field	These three varieties were omitted to be measured and weighed.				2 to 5 inches	
23. Do., new seed	Early field					8 inches	
24. Orkney red	Very late field					6 to 8 inches	Sound

Effects of Streams upon the Atmosphere. By Mr PETER MACKENZIE, West Plean, Stirling.—I have often thought that the gardeners of this country might accomplish more than they have yet done in the way of raising early crops of fruits and vegetables in the open air. If they would only graft a few more sprigs of natural philosophy on their tree of knowledge, something useful, as well as ornamental, might yet be found in many parts of the country, that are yet under the rule of briars and thorns.

Running water is often introduced to improve the appearance of the flower-garden and pleasure-ground, with good effect; but it is seldom used for the purpose of obtaining early and late crops of vegetables and fruits, which could be done in many parts of our country that abound in banks and braes, and streams in abundance. It is long since Professor Daniel told us, in his *Treatise on Meteorology*, that a running stream was useful at the bottom of a garden; but there are few gardens that have such an appendage, or a proper use made of one where it exists. But there would be no harm in making gardens where gardens never existed; and thousands of acres of waste land might be used for that purpose, and have water in abundance, from the foaming cataract and the murmuring brook.

We have often remarked that, in many parts of the country, it is pleasant to look upon the inroads which the spade and the plough are making upon waste patches of ground that abound in many places—places, too, that were at one time thought too steep to work, yet produced abundance of thistle-down, that floated gracefully upon the autumn breeze over cultivated fields and gardens—that are now producing heavy crops of useful vegetables. What has been accomplished with little trouble and expense in one place, may be done in a thousand other parts of the kingdom.

Many of the sloping banks of our rivers, that are at present covered with briars, whins, broom, blackthorn, and mountain-ash, might be formed into terraced gardens, producing flowers, fruits, and vegetables in abundance to an increasing population, and have them as early in the season as those that live in more favoured latitudes. Many of our river-banks are sheltered from the biting north and east winds, and the wild-flowers that grow there are protected from their withering influence, and the cutting blast is converted into the soft breeze that dallies with the daffodil and the primrose.

One great destroyer of early and late vegetables is the hoar-frost. We are informed by meteorologists that the white frost which appears in the mornings, chiefly in autumn and spring, is merely frozen dew. It is generally the consequence of a sudden clearing up of the weather after rains, when a considerable degree of cold is produced by the rapid evaporation. In our European climate, it usually happens that, after a fall of rain, the wind shifts into a northern quarter, and the atmosphere suddenly clears up. When this takes place during the night, or early in the morning, a strong radiation of heat from the earth commences, the cooling effect of which is increased by the copious evaporation from the wet surfaces of the plants and the grass. The influence of evaporation on the phenomenon is obvious from this, that the moisture which appears in the form of dew, before sunrise, is often changed into rime or hoar-frost on the appearance of that luminary. The reason is, that, as the atmosphere begins to get warmed by the sun's rays, the evaporation is accelerated, and consequently the cold at the wet surface of the ground augmented.

Hence we see the reason why frosty nights are so much more prejudicial to the tender shoots of plants, when they are succeeded by very bright mornings. Hence, also, hoar-frost is formed on grass or plants, when the thermometer, placed a few feet above the ground, indicates a temperature three or four degrees above the freezing-point.

Running streams through gardens have been recommended as a preventive against the injurious effects of hoar-frost upon vegetation. If the running water does good in the one place, we may naturally look for the same effects in another; and, by taking

advantage of natural laws, the steep uncultivated banks of our country may yet produce some of our earliest and best vegetables.

On the subject of cold produced by radiation, Dr Wells makes the following curious statement: "I had often," he says, "in the pride of self-knowledge, smiled at the means frequently employed by gardeners to protect tender plants from cold, as it appeared to me impossible that a thin mat, or any such flimsy substance, could prevent them from attaining the temperature of the atmosphere, by which alone I thought them liable to be injured. But when I had learned that bodies on the surface of the earth became, on a still and serene night, colder than the atmosphere, by radiating their heat to the heavens, I perceived immediately a just reason for the practice which I had before deemed useless."

Some may smile at the idea of running water protecting tender plants from the hoar-frosts of spring and autumn; but perhaps our knowledge on such subjects is not so correct as it ought to be; and those who have suffered losses from the effects of frost, will not grudge to bestow a few minutes of their time to any rational plan that may prevent disappointments in time to come.

But there are some things connected with running waters I have never clearly understood; and it may not be uninteresting to scientific men to turn their attention that way, for the benefit of the world, if it has not already been done.

Now, it would be satisfactory to know what effect the streams of our country in the spring and autumn have upon the air in their vicinity, in preventing hoar-frost being formed on their banks, and how far the cultivators of the soil could take advantage of such means in growing tender vegetables, in order to have a better supply of early and late crops, and in what condition or motion the water causes the greatest effect on the air, from "its fountains in the mountains," till it ends "with a mighty uproar."

To show that what we have been endeavouring to recommend as a national good may be put into practice, we may, in conclusion, state a fact or two, that may be ascertained by any one who may feel interested in this matter.

The banks of the Bannock are in several places very steep; more particularly from where it enters the carse ground, to near the village of Milton. In various places they appear to have undergone little change from the hands of man, since the days of Wallace and Bruce, or since James III. of Scotland was slain in Beaton's Mill; but in several places, great changes have taken place lately. By means of draining, trenching, digging, and manuring, where the feet of man or beast were seldom seen, and were in danger in such places, rich crops of vegetables, for the use of man and cattle, are now raised. Part of the banks is very steep, and yet good crops of vegetables are obtained from what may be called hanging gardens; also agricultural crops are obtained from

situations where many never expected to see them grow; and it must be gratifying to every right-minded individual to witness the effect of trade and the spade in improving Bannockburn and its neighbourhood. The thanks of the country are certainly due to those who have set the example to others, of what may yet be done in improving the waste places of the land. Above the village of Bannockburn, and near the spot where one of the kings of Scotland drew his last breath after he had fled from the battle of Sauchieburn, is a flat piece of ground, which has been cultivated for many years as a market-garden. The gardener informed me that he has observed the hoar-frost on his vegetables in a spring or autumn morning, and yet, for several feet inwards, along the bank of the stream, there was scarcely any to be seen: the running water, agitating the air, probably prevented the moisture from freezing upon the crops. Much, no doubt, will depend upon the strength of the water and the nature of the bed of the river, in preventing hoar-frost; and where time and opportunity occur for making observations and experiments, more light may yet be thrown on a subject that may prove useful to many cultivators of the soil.

Peculiar Disease in the Turnip Crop of 1852.—A disease, which I at first supposed to be that known among farmers as "the rot," made its appearance about the end of August last in the turnip crop, which, if as general and rapid in its progress as my inquiries at one time led me to fear, would have been far more calamitous in its results than the failure of the potato. It was only on September 23 that my attention was first seriously directed to the disease, so that opportunity has only been given to collect a few facts, the deductions to be drawn from which must be left to future observation.

The first field I examined was at Corehouse, near Lanark, on a farm belonging to Miss Edmonstoune Cranstoun. The field consisted of green-top whites, and, at a cursory glance, the luxuriance of the foliage was indicative of a strong and healthy, but somewhat rapid growth. On a closer examination, however, of some of the plants, a brown spot was seen on a few of the lower leaves, which presented altogether an appearance of decay, being yellow and flaccid. These blister-like spots, as in fig. 1, had an eye nearly black, surrounded by a yellowish cir-

Fig. 1.

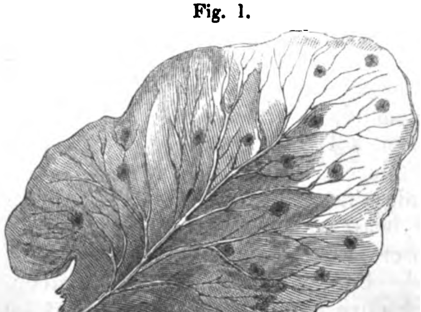


Fig. 2.

cle showing greater symptoms of decay than that presented by other portions of the leaf. On pursuing the investigation, a cicatrice or gangrenous wound, from an inch to an inch and a half in length, was seen in the crown of the bulb, as on the left side of fig. 2, the edges being somewhat jagged and dark-coloured. No other external mark of disease was apparent. On touching the bulb, it was found to yield to pressure; and on applying greater force, a semi-transparent fluid, of most fetid odour, exuded from the wound already referred to. On incision, the whole of the cellular tissue, to within two inches of the root, was found in a state of pulp, and giving off a most intolerable stench. In none of the bulbs was there any symptom of decay at the root, which always seemed pretty healthy, although, in a few instances, somewhat "fozy." To describe the bulb in familiar terms, it may be said to be a shell, half filled with a putrid pulpy mass, superincumbent on which was a semi-transparent fluid, reaching to the lower part of the crack. In nearly every instance a perfect leaf is found growing downwards into the bulb, partly immersed in the water, and presenting that peculiar blanched look common to all plants when deprived of light. This leaf is seen through the incised side of the turnip in fig. 2.

On examination by the microscope, the putrid matter was found to swarm with animalculæ, as in fig. 3. They presented, under a low magnifying power, all the characteristics of the *vibriones tritici;* but on subjecting them to a higher power, the resemblance, as in fig. 4, is nearer that of the eel of tiles. The head and tail were

Fig. 3.

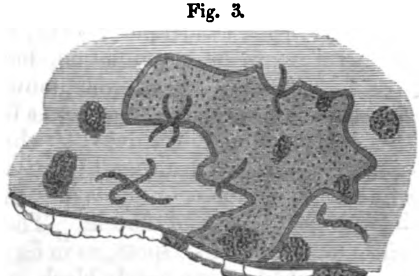
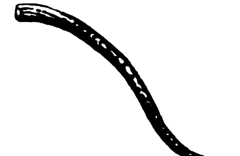


Fig. 4.



nearly transparent, and of a shining colour; the body of a yellowish

brown, and appearing granulated on its surface. In fig. 5 the head is shown more powerfully magnified. In respiration, or in the act of suction, the gullet (as I presume it to be) is withdrawn, as in fig 6, and then rapidly pushed forward. In familiar terms, it may be described as a trunk, like that of the common house-fly, but contained in the cavity of the body. The lower termination of the gullet was not very distinctly seen.

Fig. 5.

Fig. 6.

The loss by the disease in this field (twelve acres in extent) was fully one-fourth of the entire crop. It may be interesting to know that this field was drained four feet deep in 1848; and in 1850 it was broken up, limed, and subsoiled, and sown with oats the following year. The present crop (green-top whites) was sown in the first week of June, the manure applied being farmyard dung and guano in the usual proportions. At every stage the growth of the crop had been exceedingly rapid. The soil may be described as a light brown loam, and is in every way well adapted for turnips. The elevation is 550 feet above the sea, and the field has an eastward exposure.

Adjoining the green-top whites was a field of Aberdeenshire yellow bullocks similarly affected, but not to the same extent. These were sown on the 18th May. The loss on this field may be reckoned at one-tenth. The swedes on this farm (sown on 14th and 15th May) were quite free from any disease. Mr Ross, who has the management of the estate, first observed disease about the 4th September, from which time its progress was very rapid. From the time of my visit, he made daily a very careful inspection of the several fields, and noticed that the disease continued to spread until the first week of October, when it received a check, owing, no doubt, to the cold weather.

With the view of furnishing data for future investigation, Mr Ross, at my request, inoculated, on the 27th September, twenty sound bulbs of the green-top whites, and twenty of the Aberdeenshire yellows. The inoculation in ten of each kind was performed by making a vertical incision in the crown of the bulb, that being the part where the disease is first noticed. A small quantity of putrid matter from a diseased bulb was then inserted in the wound. In the remaining ten of each variety, the incision was made at the side. On the 19th October, the inoculated bulbs were examined, when it was found that, of the ten Aberdeen yellows incised at the crown—

2 were quite rotten.
4 partially so.
4 remained sound.

Of those inoculated at the side—

3 were partially diseased.
7 remained sound.

Of the green top-white inoculated at the crown—

5 were quite rotten.
2 very nearly so.
2 remained sound.

Of the same variety inoculated at the side—

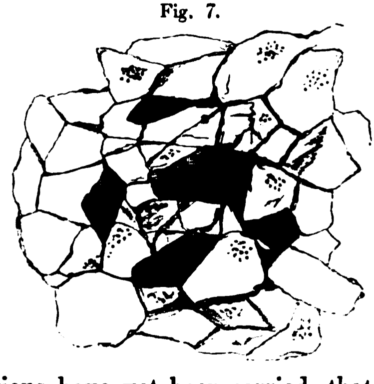
3 were quite rotten.
6 very nearly so.
1 remained sound.

The inoculation was performed alternately on the north and south sides of the bulbs; and it was found that those inoculated on the south side exhibited the disease in a much more virulent degree than those on the north.

I also examined some fields in various parts of East Lothian, where the disease had at that time made rapid strides. Here it chiefly appeared among Skirving's and the other varieties of purple-top yellows—the green-top yellows being scarcely touched, while the swedes and globes were entirely free from taint. Opportunities were afforded for examining the same kind of turnip, (Skirving's purple-top yellow,) both early and late sown, on trench-ploughed and ordinary-ploughed land; and I found that the early-sown, on ordinary-ploughed land, were diseased to fully one-half of the entire crop. On the trench-ploughed land, the loss among the late-sown extended to about one-fifth; the disease among the early-sown being, however, decidedly worse. I may mention, further, that, on the trench-ploughed land, that portion of the crop not affected was infinitely superior to that on ordinary-ploughed soil.

I subjected a portion of the tissue of a green-top white turnip (from a farm in East Lothian,) to microscopical examination, the disease being in an incipient stage, and before visible putridity commenced. Some of the cells were filled with an orange-coloured matter, nearly opaque, indicated by the dark portions in fig. 7. The portion examined was taken from an inch below the neck, and its appearance to the naked eye showed merely a slight discoloration, although the smell was somewhat putrescent. Even in this stage of the disease, the crack or wound in the crown, as in fig. 2, was clearly developed; proving, so far as my investigations have yet been carried, that the disease arises from external agency. An examination of

Fig. 7.



the tissues, during the progression of the disease, merely shows a larger number of the cells filled with the discoloured matter, until we come to what may be called its second stage, when, on cutting into a bulb an inch from the crown, and below the crack, we find the appearance indicated in fig. 8; the dark mass in the centre being a mass of corruption, as in fig. 3. The black spot on the right-hand side of fig. 8 shows the external wound proceeding inwards and downwards. Fig. 9 is a section cut from the same bulb near the root, the decay dividing about the centre of the bulb, and progressing towards the root in two channels, indicated by the two dark masses in the figure. In some instances I found the decayed matter, in its progress downwards, taking a circular form, and leaving a central portion of the turnip quite sound. In no instance have I found the decay extend to the root.

Fig. 8.

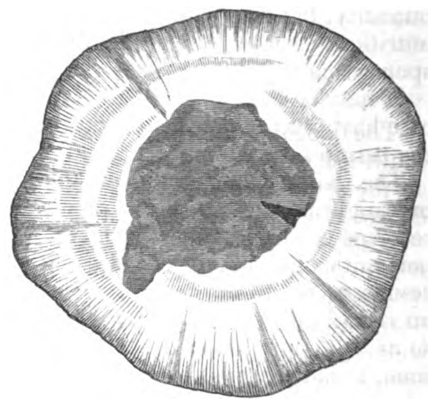
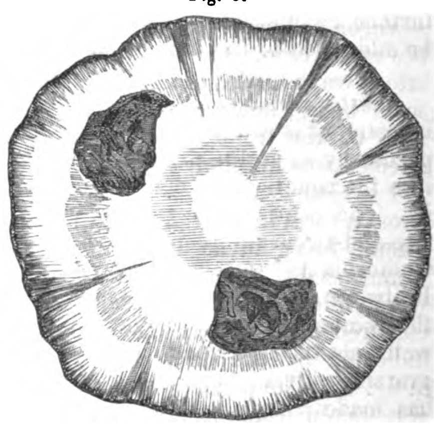


Fig. 9.



In the Experimental Grounds of Peter Lawson & Son, seedsmen, situate within a mile of Edinburgh, the state of the purple-top yellows confirms the remarks made in reference to those in various parts of East Lothian. Here also the green and red globes were affected, and also the Border imperial-purple tops, although not to the same extent. The Fettercairn and green-top swedes were likewise suffering from disease, to the extent of fully one-half the entire crop; but the nature of it, so far as I have been enabled to investigate it, is different from what I have already described: there is no brown spot seen on the leaves, neither is there any wound on the crown of the bulb. In most cases, also, we find decay in the roots, a microscopical examination of which will be seen in fig. 10, taken from a Fettercairn swede; the green-top variety

also presenting a similar appearance. I find disease also in the neck, on cutting into which a discoloured spot is seen, which gradually proceeds downwards. The result, however, in the swedes, I have invariably found to be, not putridity, but the drying up of all nutritious matter, and leaving a spongy mass.

Fig. 10.

It may be mentioned, that in no case have the tankard varieties of the turnip been attacked.

The short time allowed for investigating the disease before it received a check, afforded no opportunities for arriving at definite results as to its origin. My object, therefore, is simply to place on record all the facts which I have been enabled to accumulate, so as to supply materials for future investigation. In the mean time, I shall be glad to be placed in possession of any observations which have been made by those farmers who have suffered from the disease, as I hope to be enabled to carry my investigations further next season. Any communications relative thereto may be addressed to the care of the publishers of this Journal.

*Webster's Ireland as it is.**—The announcement of a good field for investment is a welcome piece of intelligence at any time, but it is peculiarly so at the present moment, when gold is pouring so fast into the country that millionaires do not well know what to do with it. The considerable portion which comes to this country of the five-and-twenty millions sterling per annum now being dug up in California and Australia, is putting capitalists at their wits' end. Railways are still by no means a very safe investment; and as for the Banks, interest has gone down so dreadfully that one may as well hide their guineas in a napkin as consign them to their ungrateful coffers. The Bank of England, which the Currency Act has made a regular tomb for British gold, is like to burst with superabundance of treasure; and unless Louis Napoleon considerately relieves it by a *coup-de-guerre* of some twenty millions, it is like to be grievously embarrassed by the very excess of unremunerative, uninterest-paying capital, which the wisdom of Parliament has condemned to perpetual imprisonment in its vaults.

It is in this novel state of affairs that Mr Webster comes forward with a hint to capitalists. Money is decidedly "looking down" in the market, and Labour "looking up." Gold is pour-

* *Ireland considered as a Field for Investment or Residence.* By W. B. WEBSTER.

ing into the country and men are pouring out,—interest is falling and wages rising,—and, as the *Times* says, instead of two men running after one master, we shall soon have two masters after one man! A man, therefore, can no longer content himself with living on the produce of his realised wealth, otherwise every year he will find himself descending in the money-scale, and the income which once kept him in luxury will ere long hardly suffice to sustain him in comfort. He must set his money a-fructifying in the pursuit of business, and so make the increased gains now accruing to Industry, a set-off against the diminished interest yielded by Capital.

"There is no bank in which capital may be so beneficially invested," says the Earl of Derby, "as in the soil;" a remark which all history corroborates, and which Mr Webster "repeats emphatically" as being at this time most especially applicable to land in Ireland. The Emerald Isle is the spot to which he advises all active capitalists to betake themselves; and if he does not represent it as an actual Valley of Diamonds, such as delighted the eye and filled the pockets of Sinbad of old, he at least describes it as such a green oasis in the desert of bad investments, as will amply repay the discriminating speculator who may choose it as the field of his labours. And we believe Mr Webster is right. This is by no means the first work we have read on the subject; and even after giving our sceptical spirit full sway, and making the largest allowance for prepossessions or predilections on the part of the various authors who have recently been depicting "Ireland as it is," we think it is past all dispute that their reports are in the main correct, and that nowhere will a shrewd capitalist, and still more a monied farmer, find so sure and profitable an investment for his wealth and skill.

Before going up, however, to possess this goodly land, it may be well to take a Pisgah view of it; and following the example so ably set us by Mr Webster, we are most willing to indulge our readers with the fullest account of the geological, meteorological, hydrographical, ethnographical, and politico-economical views of the subject, as may come within the humble limits of half-a-dozen pages of this Journal.

The most prominent feature of the geological structure of Ireland is, that most of the great mountain-chains are near the coast, while the central portion is comparatively level, and may almost be said to form one vast plain stretching across the island from Dublin to Galway. By far the most extensive of its geological formations is limestone; while granite, mica-slate, old red sandstone, yellow sandstone, and basaltic rocks, appear in varying proportions. In this its geological point of view, Ireland has a great advantage over England, inasmuch as we do not find there the poor sandy districts which characterise the Bagshot Heath formations; neither

are there any of the poor clay soils, such as are found on the London, the Plastic, the Oxford, and the Weald clays; the greater portion being a good loam, resting upon limestone, with thousands of acres on the old red sandstone, of fine corn-land similar to Herefordshire and Devonshire. The country is so indisputably fertile and favourable to the pursuits of agriculture, that the following remarkable testimonials in its favour are only given for the sake of those who have hitherto devoted no attention to the subject. "The luxuriance of the pasture," says Mr M'Culloch, "and the heavy crops of oats that are everywhere raised, even with the most wretched cultivation, attest its extraordinary fertility." Mr Wakefield says—"A great portion of the soil of Ireland throws out luxuriant herbage, springing from a calcareous subsoil without any considerable depth. This is one species of rich soil in Ireland, and is found throughout Roscommon, parts of Galway, Clare, and other districts. Some places exhibit the richest loam I ever saw turned up with the plough." Speaking of Limerick and Tipperary, Arthur Young declares that "it is the richest soil, and such as is applicable to every wish. It will fatten the largest bullock, and at the same time do equally well for keep, for tillage, for turnips, for wheat, for beans,—in a word, for every crop and circumstance of profitable husbandry."

The following tables exhibit the relative productive powers, per statute acre, of the soils of England and Ireland. The first shows the average crops of the cultivated land generally in the two countries:—

	England.	Ireland.
Wheat, in lb. of corn,	1,380	1,300
Barley, ...	1,872	1,820
Oats, ...	1,200	1,734
Potatoes, ...	17,920	13,669

Thus the general average of the produce per acre is in favour of England; but it must be recollected that the agricultural system of England is far before that of the sister isle; and when we come to look at the produce of the best, and naturally better attended to, soils of Ireland, we find an amount of produce to which England has nothing to compare.

PRODUCE OF THE BEST LAND IN IRELAND.

Wheat, (Waterford,) in lb.	4,200
Bere, (Limerick,) ...	4,480
Barley, (Kildare, Meath,) ...	4,480
Oats, (Derry,) ...	4,032
Potatoes, (Meath,) ...	72,100

Thus eminently fitted as are its soils for the growth of grain crops, Ireland is perhaps yet more superior as a sheep country. "The common grass, found so abundantly in almost every part, and known as the crested dog's-tail, has for years been considered

far better suited for sheep than almost any other grass. In the extensive district of fine warm land situated on the limestone, where the fall of rain is so quickly absorbed, this is strictly exemplified,—at least in one way,—the wool grown here being estimated by the manufacturers as the finest, and altogether the most valuable, they can anywhere procure."

The large quantity of bog-land in Ireland is well known. The total area of turf-bog is estimated at 2,830,000 acres, or one-seventh of the whole superficies of the country. Of this quantity more than one-half consists of flat bog, spread over the central portion of the great Limestone Plain, and the remaining portions are chiefly scattered over the hilly districts near the coast. Most of our readers are aware that a patent was taken out, and a company formed, for the conversion of Irish peat into parafine oil, compressed fuel, salts, potash, and an infinite variety of other remunerative articles; but we have heard so little of its proceedings of late, that while believing the patent itself is in principle a good one, we suspect that the company have not been able to work it with that degree of economy which is necessary to success. Be its chemical value, however, what it may, experience, as well as science, tells us that this bog-land is capable of being reclaimed and profitably subjected to the purposes of agriculture. "I have reclaimed," writes a correspondent, in whom Mr Webster puts every confidence, "some bog-land for about £7 per acre; other bogs have cost me double that sum per acre in small parts. When I say that I have reclaimed bog, (many ignorantly assert that bog never can be reclaimed,) I mean that I have got it into a state in which it will return a fair green or corn crop. When once it will do that, my object is gained, for with fair and proper treatment it will grow anything afterwards." And he adds that he is convinced that "some of the mosses will ultimately prove the most valuable of soils, when they have been properly handled." The practicability of reclaiming these bog-lands, however, is in truth rather a question for the future than for the present; for the large extent of good and improvable land now to be had in all quarters is certainly the thing that ought to, and will be first attended to; and we therefore humbly submit that the only light in which these bogs should in the mean time be regarded by farmers, is as a vast natural depot for agricultural purposes, supplying an unlimited amount of fuel, and the best material, in the shape of vegetable matter, for the manufacture of manure. There is no want of coal, however, in Ireland; and there is another kind of fuel, more peculiar to the country than even turf-bog,—namely, lignite, an intermediate species between wood and coal, found in strata, and encompassing the southern half of Lough Neagh.

Irish bogs have nothing in common with the Pontine Marshes, which lately, according to the testimony of his valet, proved fatal

to the Lord of Shrewsbury, as they have done to many hundreds before him of lesser note. An Irish bog is above sending forth malaria and suchlike noxious vapours,—justly concluding, no doubt, that there is enough of misery in the country without them; on the contrary, these bog-lands breathe a fine conservative spirit, which we hope may in due time take effect upon the *morale* as well as the *physique* of the country. "The bogs of Ireland," says our author, "communicate none of those ill effects to the atmosphere which the fens and marshes of other countries too often inflict on those residing within their precincts. On the contrary, the peasantry living in these bog districts are among the most healthy and best grown of the Irish population." So far, indeed, from being mere masses of putrefaction, these bogs are well known for their highly preservative qualities—wood and other substances being taken out of them as sound and as perfect as ever they could have been, after lying thus imbedded for centuries. And Mr Webster mentions the case of an officer, who, invalided, had tried all parts of England in search of health in vain, and never could free himself from the doctor's hands, until he fixed his residence in the very centre of an Irish bog, some 50,000 acres in extent!—in which strongly antiseptic retreat Mr Webster also spent several days, but whether for valetudinary purposes we are not informed.

Materials for building exist in profusion, and the general neglect of these materials, as shown in the wretched state of the dwellings and farm premises, concurs with the semi-civilised character of the country in suggesting the idea that a difficulty of carriage and intercommunication is one of the present impediments to progression in Ireland. Such, however, is not the case. The inland traffic, by roads, canals, rivers, and railways, is gradually becoming as complete as could be desired. The high-roads are the very best in the world, and the canals are nearly equally good. The "Grand" one, starting from Dublin, and running across the island to Shannon Harbour, has a length, including its branches, of 160 miles. The "Royal," starting likewise from the capital, and joining the natural canal of the Shannon near Longford, is 92 miles long; and the Ulster Canal, of 48 miles, links together the navigable waters of the Shannon, the Barrow, the Boyne, the Newry, Tyrone, and the Lagan navigations. Three great trunk lines of railway intersect Ireland, all starting from the capital. One line runs due west, across the centre of the island, to Galway; another runs due north, through Belfast, to Ballymena in Antrim; the third runs south-west, with three diverging terminal lines to the great seaports of the south-west, Waterford, Cork, and Limerick; while a branch of it, the Carlow Junction, opens up the communication between the capital and Kilkenny. Several other lines are at present in contemplation; and it may be generally observed, that the great levelness of Ireland presents unusual

facilities for the construction of railways, and also renders her rivers more canal-like and navigable, opening every here and there into lakes and lakelets.

"It is a mistaken notion, though a common one," says Mr Webster, "that Ireland is deficient in markets." In every town of any size, he tells us, there is a market—or, as it is more generally called, a fair—either once a-week, or once a-fortnight, to which stock and produce of all kinds are sent; in addition to which there are scattered all over the country large stores, where your corn is paid for as it is weighed out of the sack into the granary. "I have never," says a correspondent of his, "with the assistance of sea communication, found any difficulty in disposing of any quantity of farm produce at very fair prices. I have often, indeed, found the price of corn here range for some time higher than Mark Lane quotations." And when our author, in an out-of-the-way place on the coast, made a remark to an old Paddy on the want of communication with markets, "Plase yer honour," was the answer, "have we not got the railroad of all the world here—the open sea?" The communication with England is now very complete and convenient. You may leave London in the morning, and reach Dublin in the evening; or leave London in the evening, and breakfast in Dublin next morning—a few hours more taking you into Galway, Limerick, Cork, Waterford, or Belfast. We may add that it is now confidently stated that the passage between Holyhead and Kingstown, (the port of Dublin,) a distance of sixty-three miles, will be so accelerated, as to be accomplished in a couple of hours!

Such are the physical features and advantages of the country which Mr Webster now strongly recommends as a favourable field for investment. There is so much property at present for sale in Ireland, and of such infinite variety in quality, condition, and price, that an intending purchaser can hardly fail in obtaining what he requires; but in order to assist a stranger to the country in exactly suiting himself, we give the following extract from Mr Webster's volume:—

Let us ascertain the opportunity afforded for investment, and the terms upon which it may be made. As a general rule, land now selling in England at thirty years' purchase may be bought in Ireland at from twelve to twenty; and almost all, be it remembered, far more capable, and more economically to be improved upon, than any in this country. I will not, however, confine myself to generalities, but give, from my own personal knowledge, the particulars of a few estates, either now in the market, or recently disposed of. Amongst the latter is one purchased by a friend of mine, under the power of the Court. It consists of 2000 acres of land, situated on the banks of the Lower Shannon,—altogether, indeed, in a most favourable locality, and for the fee-simple of which he gave £3000. I myself was offered, in the wild part of the West, upwards of 30,000 acres, at something less than 7s. an acre, fee-smple,—the best description of mountain land here not exceeding £1 per acre. Again, in Galway, 10,000 acres for £2000; and on the Galway side of Lough Derg, 1200 acres, that, if fairly farmed, would grow any crop, for £2500. A very short time since I was looking over a property in the North, not forty miles from Belfast, the house on which, in a good state of repair, cost £60,000; the park-wall, over £3000. The land surrounding it reached very near upon 600 acres, of a superior quality; and the

timber, not including the ornamental, was valued twenty years ago at more than £20,000; none of it has yet been cut. There are two beautiful streams running through the demesne, and game of all kinds abounds. This estate was offered me, inclusive of the timber, for less than £20,000! Another twenty-thousand bargain I have seen includes a magnificent castle residence, with 1200 acres attached to it. The castle cost over £70,000—at least so it is said.

My especial attention has also been directed to the following properties, which I believe to be still for sale :—

One of 4000 acres, with good house, well-timbered demesne, and poor-rate not exceeding a shilling in the pound; present rental over £2000 per annum, which might be considerably increased,—I was offered for something like £40,000. Another, in the most beautiful part of the South, from between 8000 to 9000 acres, with not a pauper tenant on it, and poor-rates not reaching sixpence in the pound, may be bought for less than £10 an acre, fee-simple. On this property, too, there is more than £12,000 worth of young timber. I also know an estate likely to go for less than half its value, the rental of which was over £12,000 a-year, and I should have little fear but that, with a judicious outlay, it might soon be made worth as much or more. Almost adjoining this are 10,000 acres, to be had for £30,000; while small properties of from 50 to 500 acres in extent may be purchased on equally advantageous terms. The estates I have mentioned, it is right to add, contain a portion of mountain-land. In many parts of the North, large mountain farms, including portions of uncultivated land, may be purchased for £2 an acre, with fee-simple. In the South the same description of land does not reach so high a price. In the better parts of Galway, Mayo, Clare, Tipperary, Limerick, and Cork, good arable and pasture land, requiring improvement, is now offered for £6 per acre, fee-simple; and very superior land in the same counties, for from £8 to £12. Any one making a judicious purchase in Ireland now may insure a clear 5 per cent after all deductions, and have an estate that will, in all probability, be nearly doubled in value in a few years by a moderate expenditure upon it.

For those who really wish to buy land in Ireland, now is the time, for prices are rapidly rising. "There is scarcely a property purchased under the Incumbered Estates Court," says our author, "and upon which anything like permanent improvement has been attempted, but would now sell at from 20 to 30 per cent premium, and I have never yet seen an estate here which might not easily and quickly be doubled in value." The complicated and expensive proceedings attendant on the transfer of land, aggravated by the many debts and mortgages and questions of tenant right, is one great reason why capitalists have not earlier turned their attention to Irish properties. This impediment, however, has been entirely removed by the Incumbered Estates Act, in virtue of which the simple conveyance by the Commissioners is now held "conclusive evidence that every application, proceeding, and act whatsoever, which ought to have been made, given, and done previously to the execution of such conveyance or assignment, has been made, given, and done by the persons authorised to make, give, and do the same." The cost of this simple but authoritative title is very little more than the stamp duties, while it is so brief and compact that it may be easily carried in one's waistcoat pocket. There is both a Government and a poor-law valuation of every field in Ireland, which will greatly assist intending purchasers, but which ought never to be relied on by them as an infallible index of the letting value of farms.

A more important matter for a purchaser of Irish property is the permanent benefit conferred by the Government survey. For a few shillings he can obtain from the Ordnance maps, a plan of his property, with every fence and boundary distinctly marked, every house and smallest building, bog land distinguished from the other, and the elevation so minutely given, as to make draining a work of the greatest ease. So distinct and beautiful are these maps, indeed, that even the garden-walks are distinctly laid down; and every field is on so large a scale, that the nature and amount of its yearly produce can be legibly noted upon it.

The following is a brief enumeration, from Mr Webster's book, of the advantages which Ireland exhibits as a field for investment:—

> Land, of the best quality, to be had, to almost any extent, at the lowest possible price; labour equally abundant and cheap; materials of all kinds almost always at hand, or to be procured at the most economical rates; communication to all parts certain and rapid; and markets either for the sale or purchase of goods as easily attainable as in most districts. The keystone, however, to all this, we repeat, is improvement. To invest in Ireland, you must do so with the full determination to bring the land to its best uses, and to make the best use of these productions with which the country is so abundantly supplied. The stranger, too, will find every encouragement to do this. Should he not wish at first to incur a further outlay of his own capital, the Government is always ready to assist him. The Board of Works is prepared to advance money for improvements in draining, farm-buildings, fences, road-making, trenching the land, and in some cases irrigation,—the loan being repayable in twenty-one years, at the rate of 6½ per cent per annum, which in that time repays both capital and interest. One great advantage to the proprietor in availing himself of these advances is, that supposing he apply for a loan of L.5000, a portion of it—L.800, would be at once given him to commence operations with; and when he can show a judicious outlay of this, he obtains a further grant; whereas in England the full expenditure must be proved before any advance is obtained. Another important point in favour of Irish investment is, that by the present law no agricultural improvement, if executed under the Improvement Act, can be rated for the first seven years from the time of its execution.

Such are some of the material advantages which Ireland offers as a field for investment and residence; but having thus looked at the good farms which it thus holds up to sale, it behoves us next to see after the cheap labour by which they may be worked. This ethnographical, and probably most interesting portion of our subject, however, our limits compel us to reserve until next Number.

Erratum.—We are requested to correct an unaccountable error of calculation which appeared in our last Number, at page 480 of the article on "Rival Reaping-Machines." It is there stated that £144,000 had been paid by farmers in one season for Hussey's Reapers, whereas the amount should only have been £27,000—that is, 1500 machines at £18 each.—Editor.

PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 4.	49 4	32 8	20 11	33 10	32 0	35 9
11.	43 6	31 7	18 10	32 10	36 5	34 1
18.	42 9	31 9	21 6	32 1	32 10	31 10
25.	41 4	30 0	19 2	32 6	34 7	33 10
Oct. 2.	41 9	31 2	20 1	32 9	34 0	35 10
9.	40 10	30 9	19 7	32 6	34 4	34 11
16.	40 3	29 10	19 0	33 0	34 9	33 3
23.	42 9	31 11	20 1	32 2	34 11	34 4
30.	44 1	31 7	19 7	26 9	37 11	35 2
Nov. 6.	42 2	31 0	19 3	27 2	41 10	35 1
13.	45 5	32 5	19 8	27 5	39 10	36 5
20.	43 9	32 9	20 3	27 1	40 3	36 1
27.	45 0	32 0	19 6	27 0	36 4	35 0

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 1.	42 5	26 5	20 9	33 0	33 6
8.	41 0	26 3	21 1	33 4	33 11
15.	41 1	26 2	21 5	32 3	32 9
22.	41 1	26 1	21 6	33 6	34 6
29.	42 4	26 4	21 2	33 0	33 6
Oct. 6.	42 9	27 2	20 10	33 4	34 2
13.	44 1	27 5	20 6	34 1	34 8
20.	44 1	28 0	19 5	34 6	35 1
27.	44 2	28 2	20 8	34 4	34 10
Nov. 3.	43 7	28 3	20 5	34 9	35 5
10.	44 4	28 6	20 0	34 3	34 9
17.	45 0	28 9	20 2	34 10	35 5
24.	46 1	28 10	19 6	34 9	35 4

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 4.	42 1	26 4	16 9	26 2	32 9	35 6
11.	42 2	28 1	17 4	26 6	31 6	34 4
18.	40 9	28 1	17 10	27 0	31 2	33 2
25.	41 7	27 7	17 11	27 3	30 10	32 1
Oct. 2.	39 11	26 5	17 4	26 4	30 6	32 6
9.	40 1	26 3	17 1	24 11	30 2	34 5
16.	40 8	25 9	21 1	25 6	31 4	33 1
23.	40 9	27 9	17 8	25 10	31 6	33 1
30.	41 7	27 7	17 9	26 0	32 2	30 0
Nov. 6.	41 10	28 3	17 6	25 8	33 9	34 6
13.	42 9	26 10	19 2	25 11	35 8	37 1
20.	42 8	28 9	18 3	26 2	36 0	36 6
27.	43 3	29 1	17 11	26 8	34 2	32 4

DUBLIN.

Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bere, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour, p. barl. 9 st.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 3.	23 1	13 8	9 6	9 1	14 0
10.	23 4	13 10	9 9	9 5	14 1
17.	23 1	12 5	9 7	10 1	14 0
24.	22 0	11 6	9 4	9 6	13 11
Oct. 1.	22 1	13 5	9 8	10 0	14 3
8.	23 6	12 5	10 2	9 4	14 2
15.	24 0	13 2	10 6	9 7	14 3
22.	24 3	13 3	10 9	10 2	14 4
29.	24 4	12 5	11 3	10 3	14 3
Nov. 5.	24 2	13 10	11 8	9 11	14 5
12.	25 4	13 11	12 5	9 9	14 2
19.	24 9	14 1	12 7	9 10	14 1
26.	25 8	14 4	12 10	10 2	14 4

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vic., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat. Weekly Average.	Wheat. Aggregate Average.	Barley. Weekly Average.	Barley. Aggregate Average.	Oats. Weekly Average.	Oats. Aggregate Average.	Rye. Weekly Average.	Rye. Aggregate Average.	Pease. Weekly Average.	Pease. Aggregate Average.	[illegible] Weekly Average.	[illegible] Aggregate Average.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 4.	44 9	41 5	28 2	27 8	20 5	20 0	31 3	30 0	31 6	31 3	34 10	34 0
11.	42 5	41 10	27 10	27 8	18 10	19 9	30 9	30 2	31 9	31 0	34 5	34 0
18.	40 5	42 0	27 4	27 9	18 7	19 6	30 1	30 3	29 10	30 11	34 4	34 1
25.	39 6	42 0	27 5	27 9	17 11	19 3	31 0	30 4	29 10	30 8	33 10	34 2
Oct. 2.	38 9	41 7	27 4	27 9	17 4	18 11	30 5	30 6	30 0	30 8	33 10	34 3
9.	38 5	40 9	27 5	27 7	17 6	18 5	28 10	30 5	30 4	30 7	34 0	34 3
16.	37 10	39 7	27 8	27 6	18 0	18 0	30 1	30 2	30 4	30 4	34 1	34 1
23.	38 8	38 11	28 8	27 8	17 10	17 10	25 8	29 4	30 9	30 2	34 2	34 1
30.	39 2	38 9	29 5	28 0	17 6	17 8	26 0	28 8	31 5	30 5	34 7	34 1
Nov. 6.	39 5	38 8	29 9	28 5	18 3	17 9	24 10	27 7	33 5	31 1	35 3	34 4
13.	39 11	38 11	30 2	28 10	18 7	17 11	27 8	27 2	32 6	31 5	35 4	34 7
20.	40 0	39 2	30 6	29 4	18 9	18 2	29 9	27 4	33 3	31 11	35 6	34 10
27.	40 5	39 7	30 7	29 10	18 6	18 3	27 1	26 10	32 3	32 3	35 2	35 0

FOREIGN MARKETS.—Per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Sept. ..	Danzig	38 6 - 45 6	18 0 - 27 6	12 0 - 15 6	25 6 - 29 6	25 6 - 32 0	21 6 - 27 0
Oct. ..	Danzig	40 6 - 46 0	22 6 - 30 0	14 6 - 20 0	26 6 - 30 6	26 6 - 32 6	25 0 - 30 0
Nov. ..	Danzig	43 6 - 48 0	23 6 - 30 6	15 6 - 20 0	25 6 - 30 0	26 0 - 32 0	26 0 - 30 6
Sept. ..	Hamburg	34 6 - 42 0	23 0 - 29 0	12 6 - 16 0	26 6 - 31 0	28 6 - 34 6	23 6 - 27 6
Oct. ..	Hamburg	36 6 - 43 0	25 6 - 33 0	13 6 - 17 3	27 6 - 32 0	30 6 - 37 0	25 6 - 33 6
Nov. ..	Hamburg	37 6 - 45 0	27 6 - 34 0	14 0 - 17 6	29 6 - 33 6	32 6 - 38 0	25 0 - 33 0
Sept. ..	Bremen	33 6 - 39 6	21 0 - 28 0	12 0 - 15 6	23 6 - 27 0	26 6 - 33 6	22 6 - 26 6
Oct. ..	Bremen	35 6 - 41 6	22 6 - 28 6	12 6 - 16 0	24 6 - 28 6	27 6 - 34 6	24 6 - 28 6
Nov. ..	Bremen	36 6 - 42 6	23 0 - 29 0	13 0 - 17 0	26 6 - 30 0	28 6 - 35 6	25 6 - 30 0
Sept. ..	Königsberg	36 6 - 43 0	20 6 - 26 6	13 0 - 16 0	22 6 - 26 0	24 6 - 30 6	21 6 - 26 6
Oct. ..	Königsberg	37 6 - 44 0	21 6 - 27 6	13 6 - 16 6	24 6 - 28 0	26 6 - 32 0	24 0 - 28 6
Nov. ..	Königsberg	38 6 - 46 0	22 6 - 29 6	14 0 - 17 0	25 6 - 29 6	27 6 - 33 6	25 0 - 30 0

Freights from the Baltic, 3s. 3d. to 5s. 6d.; from the Mediterranean, 6s. 6d. to 9s.; and by steamer from Hamburg, &c. 2s. to 2s. 6d.

THE REVENUE.—From October 1851 to October 1852.

	Quarters ending Oct. 10. 1851.	Quarters ending Oct. 10. 1852.	Increase.	Decrease.	Years ending Oct. 10. 1851.	Years ending Oct. 10. 1852.	Increase.	Decrease.
	£	£	£	£	£	£	£	£
Customs....	5,335,073	5,036,809	..	298,264	18,798,262	18,713,510	..	84,752
Excise......	4,139,854	4,303,755	103,901	..	13,256,120	13,370,305	114,185	..
Stamps.....	1,432,564	1,529,421	96,857	..	5,965,785	6,099,717	133,932	..
Taxes	165,025	159,215	..	5,810	4,301,093	3,143,892	..	1,157,201
Post-Office ..	306,000	261,000	..	45,000	970,000	996,000	26,000	..
Miscellaneous	68,452	57,799	..	10,653	332,058	512,295	180,237	..
Property Tax	1,870,136	1,915,581	45,445	..	5,355,697	5,409,355	53,658	..
Total Income	13,317,104	13,263,580	146,203	359,727	48,979,015	48,245,074	508,012	1,241,953
	Deduct increase			146,203	Deduct increase......			508,012
	Decrease on the qr...			213,524	Decrease on the year..			733,941

PRICES OF BUTCHER-MEAT.—Per Stone of 14 Pounds.

Date.	London. Beef.	London. Mutton.	Liverpool. Beef.	Liverpool. Mutton.	Newcastle. Beef.	Newcastle. Mutton.	Edinburgh. Beef.	Edinburgh. Mutton.	Glasgow. Beef.	Glasgow. Mutton.
1852.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Sept. ..	4 3 - 6 3	4 6 - 6 6	4 3 - 6 6	5 3 - 7 6	4 3 - 6 3	5 6 - 7 6	4 6 - 6 0	5 6 - 6 3	5 6 - 6 6	5 6 - 6 6
Oct.	4 3 - 6 6	4 9 - 6 9	4 6 - 6 9	5 6 - 7 0	4 6 - 6 6	5 6 - 7 3	4 9 - 6 3	5 9 - 6 6	5 6 - 6 6	5 9 - 6 9
Nov. ..	4 6 - 6 9	5 3 - 7 3	5 9 - 7 0	6 0 - 7 3	5 6 - 6 3	5 9 - 7 0	5 0 - 6 6	5 9 - 6 9	5 6 - 6 9	6 0 - 7 0

PRICES OF ENGLISH AND SCOTCH WOOL.—Per Stone of 14 Pounds.

ENGLISH.	s. d. s. d.	SCOTCH.	s. d. s. d.
Merino, ...	14 6 to 19 6	Leicester Hogg, ...	14 0 to 19 6
.. in grease, ...	10 6 to 15 0	.. Ewe and Hogg, ...	11 0 to 16 0
South-Down, ...	16 0 to 20 0	Cheviot, white,..................	13 6 to 15 6
Half-Bred, ...	11 6 to 16 0	.. laid, washed, ...	8 6 to 11 6
Leicester Hogg, ...	14 0 to 20 0	.. .. unwashed, ...	6 9 to 9 0
.. Ewe and Hogg, ...	11 6 to 16 6	Moor, white,.....................	6 6 to 8 9
Locks, ...	7 6 to 9 0	.. laid, washed, ...	5 9 to 7 9
Moor, ...	6 0 to 7 0	.. .. unwashed, ...	5 3 to 6 3

THE AGRICULTURAL GEOLOGY OF ENGLAND AND WALES.

By Mr Thomas Rowlandson, C.E., F.G.S., London.

The term geology is derived from the Greek words *Ge*, the earth, and *Logos*, a word or discourse, and is that science which attempts an explanation of the *modus operandi* by which the existing physical appearance of the earth has been produced; in familiar terms, it may be defined as "the science which describes the solid materials of the earth, the order in which they are arranged, the causes that have affected that arrangement, and the organic remains which are found in them." The utility of this science in many branches of agricultural and mining operations is generally admitted; and Sir John Herschel, in his *Discourse on the study of Natural Philosophy*, asserts that "geology, in the magnitude and sublimity of the objects which it treats, undoubtedly ranks in the scale of the sciences next to astronomy."

The rocks which compose the superficial crust of the earth have been originally formed by the agencies of fire and water, to which the terms igneous and aqueous are respectively applied; when, however, the rock has evidently been originally formed by deposition, but has become indurated by the action of intense or long-continued heat, the term metamorphic is applied, in order to describe its present changed aspect from its original character.

The igneous rocks are generally termed, in the language of geology, plutonic rocks; and recently, the term hypogene, "nether formed," has been proposed for those which have not assumed their present form and structure at the surface, such as granite, gneiss, &c. The last term, which includes both the plutonic and metamorphic rocks, is substituted for the old term primary, because some members of both these classes, such as granite or gneiss, are posterior to many secondary fossiliferous, and consequently recently formed rocks. As a popular illustration of this circumstance, it may be mentioned that the dip of the chalk formation in the west of Dorset evidently indicates that the huge granite mass of Dartmoor has been upheaved into its present position posterior to the deposition of the chalk (a comparatively recent formation) in horizontal beds. Notwithstanding this circumstance, the term primary is so generally acknowledged as a term applied to the lowest rock of the geological series which man has yet, or is very likely to reach, that it will be better in the course of this paper to use the term primary in its ordinary accepted sense. Although granite is here described as the lowest known rock, it is occasionally found to constitute very elevated districts, particularly in the Alps. Even if the point is conceded that granitic rocks are the last formed, the term primary would strictly apply, if used as descriptive of an ascending series; and, in consequence of being the

most popularly accepted term for this species of rock, it will frequently be applied in that sense in the course of the following pages.

The generally accepted opinion that all the subsequently formed aqueous rocks have originated from the disintegration of pre-existing igneous rocks analogous to granite, has not been absolutely proved, though the great preponderance of evidence is favourable to that conclusion. For all the practical purposes of the agriculturist this opinion may be received as an axiom. We may, however, at a future period, have occasion to make some further observations on the alterations which have taken place amongst the lowest stratified beds, owing to igneous action; some of which are of importance, as connected with the degree of fertility of the soils which are formed by their subsequent decomposition.

The mighty changes which have taken place on the earth's surface are due to a combination of causes, some being elevatory, others of subsidence—either of which might have been sudden, as in earthquakes, or as seen by violent volcanic action; or gradual, as the progressive rise of the land, which is stated to have been in silent progress for a long period in Scandinavia. The elevation and submergence of the land is proved by the character of the organic remains found in strata of different depths, some indicating that they were terrestrial animals, others, that they were marine; whilst several, especially amongst the most modern deposits, indicate that they were deposited in large fresh-water lakes, such as those now existing in the North American continent. No better proof can be found of the repeated alternation of land and sea over the same area of the globe, than that which is exhibited in the coal-measures. The vegetable origin of coal is now admitted on all hands; and the researches of Mr Binney have clearly shown that, in the vast majority of cases, the coal-beds are formed of the carbonaceous remains of plants which grew on the places where the coal-beds are now found. The researches of fossil botany have shown that the flora which occupied our coal-fields was composed of plants of terrestrial origin—in fact, such as now inhabit intertropical climates. Above and below the various beds of coal are arenaceous and argillaceous beds, containing the remains of marine crustacea and fishes. This alternation of remains, evidently of terrestrial origin, in one set of beds, but of marine in others, indicates the number of successive changes which have taken place within the same area, the surface having been alternately occupied by land and sea. So numerous are these, that it has been proved in the Lancashire coal-field, that the land must have been submerged and elevated at least one hundred times during the formation of the beds, commonly known as the coal-measures.

Contemporaneous with the phenomena of elevation and subsidence just alluded to, the degradation of mountains and filling-up

of valleys were slowly proceeding; the combined action of moisture and carbonic acid disintegrating the hardest rocks, the loosened particles being carried to lower levels by means of streams. The degrading influence of the sea waves is also important, and is seen rapidly progressing on many parts of the eastern and southern coasts of England. To such an extent has this taken place in some situations, that marked changes in the features of the coast have been observed within very recent periods. Reculver church is a remarkable instance of denudation. Reculver was an important military station in the time of the Romans, and appears, from Leland's account, to have been, so late as Henry the Eighth's reign, nearly one mile distant from the sea. In *The Gentleman's Magazine* there is a view of it, taken in 1781, which still represents a considerable space as intervening between the north wall of the churchyard and the cliff. Some time before the year 1780 the waves had reached the site of the ancient Roman camp or fortification, the walls of which had continued for several years, after they were undermined, to overhang the sea, being firmly cemented into one mass. They were 80 yards nearer to the sea than the church; and they are spoken of in *The Topographia Britannica*, in the year 1780, as having recently fallen down. In 1804, part of the churchyard, with some adjoining houses, was washed away; and the ancient church, with its two lofty spires, a well-known landmark, was dismantled and abandoned as a place of worship, and would have been swept away ere this, had not the force of the waves been checked by an artificial causeway of stones and piles driven into the sand.

In contradistinction to the above, may be mentioned the conservative effect of sand downs in some places, well anthenticated instances being on record where churches and villages have been destroyed by inundations of sand, the destruction so caused being more than compensated by the barrier thus formed to the further encroachments of the sea.

The age of the aqueous-formed rocks was formerly ascribed to their respective positions in the downward series, and much reliance was placed upon the lithological character of rocks. It was soon found that this method was productive of much error, for it is impossible to distinguish limestones obtained low in the silurian formations from the mountain limestones, whilst sandstones of almost every age may be obtained similar in appearance to many of the beds composing the new red sandstone series. This remark particularly applies to beds of like character found amongst the old red sandstone, the coal-measures and new red sandstone formations. Owing to the similarity here noticed, the older geologists were apt to fall into very serious errors relative to the order of superposition of different rocks—a confused state of things, which has only of late years been remedied by modern

researches, which have given rise to two branches of science of the utmost importance to geology—namely, fossil botany and palæontology, or the sciences which treat of fossil remains.

By means of these sciences it is clearly shown that the fauna and flora of the ancient fossiliferous world have undergone a series of changes, those found in the older rocks being of different character from those which have had their being at the time of the deposition of the superposed and newer rocks. Until this marked distinction of the organic remains of different formations had been clearly proved, the greatest confusion existed, owing to the anomalies presented by overlaps and faults. In the course of describing the various rocks in the British islands, additional particulars on this subject will be given. The student in geology should be careful, in making his observations, that he must not anticipate to find the immediate beds pertaining to the descending series always underneath those adjoining the surface: in some cases whole formations are wanting, having either never been formed, or the preexisting state of the earth's surface was unfavourable to their deposit. This might arise from being placed in the profound depths of an immense ocean, far away from the influence of rivers, and too deep for the existence of organic life; or the opposite circumstance may have taken place—viz., being elevated above the action of rivers and seas. The latter is the most probable cause in the greatest number of cases, particularly where beds thin out, as it is termed.

By means of geological diagrams and maps of England, a pretty distinct conception may be formed of the varied distribution of the different surface rocks, and will give the reader a much more vivid idea than the most elaborate description.

Excepting in the case of overlaps, which are circumstances of extremely rare occurrence, only being found in this country—in South Wales amongst some of the older rocks, and at Neston in Cheshire, amongst the coal-measures—it may always be inferred that the superior rocks of the series are absent whenever an older rock forms the surface. Thus, if the old red sandstone forms the surface rock, it would be vain to look for the mountain or carboniferous limestone by sinking through the old red sandstone, or to obtain coal.

An inspection of a geological diagram will show that the organic life of the ancient world commenced with the class of animals lowest in the scale of creation, rising gradually to those of a higher order, until man made his appearance within a comparatively recent period. A most talented geologist (Sir Charles Lyell) disputes this gradual development of a superior race of beings. The general opinion, however, of geologists of equal eminence is, that such an order of things has taken place, a vast number of species of the earliest inhabitants of the earth became gradually extinct—having, however, somewhat analogous representatives in exist-

ing species amongst the lowest class of life, if such a term can be admitted where the apparently meanest creature is made to perform some important part amongst created beings.

General view of Strata.—Commencing with what is usually termed the primary rock granite, it will be found that very little of the surface of England is occupied by this rock, the forest of Dartmoor possessing a more extensive area than the combined surfaces of the other granite districts, found in the adjoining county of Cornwall, and the very limited areas near Ravenglass in Cumberland, and a few solitary points in Anglesea. Granite districts are usually very desolate, having frequently a subsoil of stiff retentive clay with a peat covering; the latter generally much intermixed with quartz, forming the Growan soils of Cornwall, an account of which is given in Mr Karkeek's report of that county. One cause of the barren character of soils, immediately superposed on granite, undoubtedly arises from its elevated character, and being exposed to such a humid climate as exists on the high granitic districts of the West of England. This opinion is further corroborated by the more valuable character of the soil covering the granitic district of the Land's End, which is of much less elevation.

Owing to the important part which the constituents of granite are supposed to play in the formation of other rocks, an analysis of its mineral composition is of the utmost importance in the present inquiry.

Granite is principally formed of—1. quartz, (flint or sand,) the chemical term for which is silica or silicic acid, and is identical with the yellow exterior covering of the gramineæ. 2. Felspar, a crystalline substance of various shades, from an opaque white to flesh colour. 3. Mica, a glittering silvery substance, dividing readily into flakes. Hornblende and augite, two substances of similar character, also are occasionally found in granite, in which case that rock assumes a dark green colour. According as these substances preponderate depends the compactness or undecomposable character of the granite, and also the value to the husbandman of the soils formed from its disintegration. The following is the chemical composition of some of the above minerals—

	Augite.	Hornblende.
Lime,	24.74	14.19
Magnesia,	18.22	18.84
Manganese,	0.18	9.22
Oxide of iron,	2.50	7.55
Silica,	54.16	47.53
Alumina,	0.20	12.67
	100.00	100.00

The fertile character of soils formed from hornblende rocks clearly shows that potash forms a constituent, although overlooked by analysts.

Micas are of varied composition, their general character not being greatly dissimilar from chlorite, as will be seen from the following analyses:—

Chlorite.		Uniaxial or Magnesia Mica.		Biaxial or Potash Mica.	
Magnesia,	14.69	Magnesia,	16.15	Potash,	10.09
Manganese,	0.47	Manganese,	0.58	Oxide of iron,	1.50
Oxide of iron,	26.87	Oxide of iron,	9.36	Peroxide of iron,	3.35
Alumina,	18.47	Peroxide of iron,	10.38	Alumina,	37.36
Silica,	26.06	Alumina,	12.83	Silica,	47.70
Water,	12.00	Silica,	42.12		
Potash,	1.44	Potash,	8.00		
		Water,	.58		
	100.00		100.00		100.00

In these minerals, oxide of iron and magnesia act the part of bases in varied proportions; the mineral will, however, be found of easiest decomposition in proportion as the oxide of iron predominates.

Of all minerals, the decomposition of which produces soils, those composing the felspathic series are by far the most important. Potash felspar is softer than quartz, but harder than apatite; gives faint sparks with steel. If powdered felspar is gently ignited with lime, and the mass digested with water—or if powdered felspar, previously ignited, is boiled with milk of lime—it gives up its potash to the water, the lime taking the place of potash in the compound.

Felspar in a state of minute division is not sensibly acted upon by water at a temperature of 100° centigrade, 212° F.; at 257° F., in a Papin's digester, it renders the water feebly alkaline; at 302° F. strongly, and at 428° F. still more strongly alkaline.

The silicate of potash is probably dissolved out in this process, which is of the same nature as the slow efflorescence by which felspar is decomposed in nature; for when potash felspar, a silicate of alumina and potash, yields a silicate of potash to water, there remains a silicate of alumina, which, combined with two atoms of water, forms clay, the formula being, $Al.^{2}, O.^{3}, 2\ Si.\ O.^{2} + 2$ water. In nature, however, it is generally found mixed with carbonate of lime, magnesia, and oxide of iron, in small quantities, from which it acquires the property of effervescing with acids; it is also frequently mixed with minute amounts of hydrated sesquioxide of iron and hydrated sesquioxide of manganese, finely-divided quartz, felspar, albite, mica, spodumene, organic matter, &c., all of which modify its properties and applications to a considerable extent. The colour of clay is modified principally by the greater or less extent of oxide of iron present, as well as by the kind of oxide.

Pure clay is soft, more or less unctuous to the touch, white and opaque, and emits a peculiar odour when breathed upon. The last-named peculiarity has been long attributed to the presence of

ammonia, for clay emits a stronger smell when treated with a solution of caustic potash, by which the ammonia is expelled; but after the ammonia is all driven off, the odour entirely ceases. Clay is converted by water into a doughy mass, of various degrees of tenacity, but loses this quality on drying. When rapidly heated it cracks in every direction; but when slowly heated, it parts with its water at a temperature below redness, at the same time decreasing in bulk. If heated to redness it still continues porous, and may be saturated with water without immediately falling to pieces. Long-continued aqueous action, however, gradually converts burned or anhydrous clay into the original hydrated form: this is best seen in the decomposition which takes place when partially burned bricks are submitted to the action of the atmosphere.

By boiling clay with a solution of potash, a double silicate of alumina and potash is formed, which is dissolved more perfectly in proportion to the excess of potash employed. The properties here noticed have an important bearing on the quality of soils, to which may also be added that of alumina possessing within certain limits the power of absorbing azotised compounds; which quality also pertains to the peroxide of iron,* the latter being generally found as a constituent in the most fertile clays. The above properties also throw some light on the experiments of Professor Way respecting the absorptive properties of soils containing alumina, particularly as Professor Way found that burning clay destroyed its absorptive powers in this respect. In albite, or soda felspar, the alkali potash is replaced by the alkali soda. When, however, a portion of the soda is replaced by potash, the mineral is called pericline, and potash albite. This mineral is much less decomposable than potash felspar, and is frequently seen in large crystals in the compactest descriptions of granite.

Analysis of potash and soda felspars:—

Potash Felspar.		Albite or Soda Felspar.	
Potash,	16.59	Soda,	11.62
Alumina,	18.06	Alumina,	19.13
Silica,	65.35	Silica,	69.25
	100.00		100.00

The decomposition of the preceding described minerals, and their subsequent mechanical admixture, often with the addition of lime in the form of carbonate, has given rise to all our cultivatable soils as well as the different rocks which compose the surface of the

* The recent experiments of Professor Way throw some doubt on this property, commonly considered as a quality of alumina. Professor Way rather attributes it to the influence of the double silicate of alumina and lime.—Since this was written, a most able paper on the subject has been published by Professor Way in the *Journal of the Royal Agricultural Society of England,* in which it is pretty clearly shown that the valuable absorptive properties of clay soils is owing to the presence of the hydrated double silicates of alumina, lime, and soda, &c.

earth, the alumina and oxide of iron in the form of a finely-divided mud being carried by fluviatile and oceanic agency over immense areas, forming our slate beds—quartz, from its more ponderable character, being precipitated in a more confined, but still a wide area, forming silicious beds amongst all formations, sometimes in large compact masses, as in sandstone rock; other times as heaps of incoherent sand, as in the green and Bagshot sands; and occasionally parted by horizontal fissures into flagstones.

Igneous rocks other than granitic are also formed of the substances previously named, but which have undergone an alteration by fusion. Thus greenstone, one of the most frequently occurring trap rocks, is merely felspar, quartz, limestone, and hornblende re-melted and thrown up to the surface of the earth. Basalt, trachyte, and numerous volcanic products, are of similar character. Porphyry (the Elvans of Cornwall) is principally composed of felspar, intermixed with pieces of quartz and other rock, according to the predominating character of which a descriptive term is given.

There exists an immense number of other minerals, the decomposition of which gives origin to soils—a description, however, of which would have extended this paper beyond all reasonable limits. Let it suffice to say, that the minerals already noticed possess the elements from which all soils have been formed, for they contain an exceedingly small proportion of phosphate of lime. This substance is also not unfrequently found in a compact form, as apatite; generally, however, only in small quantities, the great exception being in the case of the phosphoritic beds of Estremadura.* Lime also forms a greater or less constituent of granitic minerals, sufficiently so in the form of carbonate to account for the carbonate of lime which has been accumulated by marine animals in the form of limestone and chalk; and by lacustrine species, as limestone and marls.

From causes already noticed, granitic soils are not usually agriculturally productive; in fact, so far as the husbandman is concerned, they may generally be classed as tough retentive clays or peat, and will come under review at a subsequent period.

Gneiss and mica schist do not exist to any considerable extent in England or Wales; they are, however, found in some places where igneous rocks have protruded, in the vicinity of particular descriptions of slates, by which the latter have been converted into mica schists. As, for all the practical purposes of the agriculturist, these rocks do not exist in England, they may be safely dismissed from the inquiry. Some have referred the Malvern Hills to this class of rocks: they, however, more properly belong to the class of syenites. A very talented geologist, Professor John Phillips,

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* To some extent recently discovered in America.

states that there exists in the Malvern rocks, granite, syenite, greenstone, hornblende rock, felspar rock, serpentine rock, epidotic rock, and other products of igneous action; also that a product which cannot be technically distinguished from gneiss is abundant.

The rocks of the Malvern Hills are composed principally of quartz, felspar, mica, chlorite, hornblende, and epidote, felspar being the most abundant; hornblende holding the second rank, with a variable proportion of quartz; the most frequent rock being a richly-coloured red syenite. The previously described composition of these minerals will prepare the reader to anticipate that the alluvial soils formed from their decomposition must be of great value: such is known to be the case in the vales of Gloucester and Evesham, which are remarkable for their fertility, whether as regards arable, grazing, or garden ground.

Trap, greenstone, and basalt, when decomposed, usually form fertile soils, their disintegration being much facilitated by the presence of lime and oxide of iron. When the two latter are present in considerable quantity, the soils formed by their decomposition is usually very fertile. The presence of igneous rocks amongst sedimentary ones is often productive of increased fertility, a moderate amount of heat having a tendency to promote decomposition. On the other hand, a very intense igneous action not unfrequently converts the adjoining disrupted rock into one of an exceedingly hard and undecomposable character; in which cases the neighbouring soil will usually be found of a strong and infertile description. Instances of both kinds will be given by way of illustration, when slate rocks are under notice.

Diallage and serpentine rocks are both found in Cornwall, covering moderately extensive areas. The former generally possesses a rough stony character, but the soil is pretty fertile; the latter is very barren, and is remarkable for the abundance of the beautiful heath, the "erica vagans," which is produced on it. Veins of diallage and hornblende frequently run through the serpentine, in which cases the soil is improved in character. It is difficult to reconcile the remarkable difference of fertility between soils formed of decomposed serpentine and diallage, seeing that their composition so nearly approximates.

Analysis of serpentine and diallage:—

	Serpentine.	Diallage.
Magnesia,	36.68	16.57
Silica,	42.50	54.80
Alumina,	2.00	2.84
Lime,	1.25	17.02
Oxide of Iron,	1.50	7.78
Do. Manganese,	.67	trace.
Water,	15.40	.99
	100.00	100.00

The preponderating amount of lime in the diallage rock will not account for the superior fertility of soils formed by its decomposition, for there exists a greater quantity of lime in serpentine than is found in some of our most fertile meadows. The difference may perhaps be more correctly attributed to the mechanical, rather than the chemical composition of the two soils, the lime and silica of the diallage tending to form a more pervious soil, whilst in the serpentine a hydrated silicate of magnesia is perhaps formed, which is of a remarkably retentive and impervious nature. Serpentine is found at the Lizard, and a small patch near Liskeard.

Clay slate, the Killas of Cornwall, is principally developed in Cornwall, North and South Wales, Cumberland, and Westmoreland. That kind of which roofing slates are formed is mainly composed of clay, coloured red with oxide of iron, or green with sulphate of iron, (common copperas.) It is usually found in abrupt elevated masses, incapable of being made use of agriculturally, other than as sheep-walks, or for the growth of coppice-wood or timber; and it is admirably calculated for the growth of larch. Thin beds of limestone occasionally intervene between the beds of slate, which are not unfrequently of considerable agricultural value for conversion into lime, to be subsequently applied to the peat, which occasionally covers extensive areas of this formation. The distinctive character of the soils formed on slate rocks is similar to that which is found to take place on many members of the upper and lower silurian series, found in the country adjoining the districts already noticed as the localities of clay slate. To some of these beds the term grauwacke has been applied:—this is, however, slowly giving way to the term silurian.

The upper and lower silurian rocks occupy very extensive breadths of country in North and South Wales, Cornwall, West Somerset, and part of Devon. The lowest rocks in the series are usually very compact and arenaceous, forming as ungenial a soil as is to be found in the United Kingdom, many beds being much hardened by irrupted greenstone and trap rocks, especially near the Precelly range in South Wales. From the district just noticed to the upper Berwins, North Wales, a large tract of inhospitable country exists; whilst to the north of the Dee, in the county of Denbigh, is to be found a considerable extent of barren country belonging to the upper silurian system.

Along the banks of the Dee, and at the eastern foot of the Berwins, is a series of hills of moderate elevation, of a slaty character, and composed of the same materials as clay slate, which easily decomposes—from which circumstance they have been termed mudstones, and give rise to very fertile soils in the neighbouring valleys. Favourable specimens are to be seen in the Vale of Chirk, and the vicinity of Llangollen. Rocks of like character occupy a considerable space in Montgomeryshire, in the vicinity of Llan-

fair and on the banks of the Vyrnway and Severn. In Cornwall, Cumberland, Westmoreland, &c., like soils are produced wherever particular beds of the silurian age present themselves to the surface.

In the west of England, and the borders of Wales and England, the soil in many places is formed of volcanic ash: there the soil is known under the name of Dunstone, and is remarkable for its fertility. A particular description, greatly esteemed, is known by the name of Honeycomb Dun, being composed of a vesicular trappean ash. On the borders of Shropshire, Montgomery, and Radnor, the surface soil in many places is formed of a trappean felspathic ash, which somewhat assimilates in character with the Honeycomb Dun of the west of England. Wherever this is found, the soil is remarkably fertile. The deposition of the upper and lower silurian rocks occupied an immense period of time: they consist of beds of slates, analogous to clay slate, sandstones, and limestones: the Bala, Hirnaut, and Coniston limestones being the lowest in the series in their respective localities. In the upper beds, limestones are more plentifully distributed, and are known, with their shales, under the respective names of Wenlock, Dudley, and Aymstry.

Superposed on the silurian rocks is the old red sandstone or Devonian rocks. For some time the old red sandstone rocks of Devon held a somewhat anomalous place in the geological series; modern researches have, however, ultimately placed them amongst the old red sandstone beds. These rocks are principally developed in the west of England, in the counties of Hereford, Monmouth, and Brecon, with spurs and outliers in the counties of Worcester, Gloucester, and Salop. The whole series consist of immense deposits of conglomerates and sand, usually highly tinged with the peroxide of iron, possessing also in many of the beds concretionary nodules of limestone, and magnesian limestone and marls, known in the districts under notice by the name of Cornstones. The finest orchards of Herefordshire, and its best oaks, (*the weeds of Herefordshire,*) grow on these cornstones.

Succeeding the old red sandstone is the carboniferous series, commencing with the mountain or carboniferous limestone. This is found in two bands in the west of England—one extending from near Exeter to Launceston, the other forming the Mendip Hills in Somersetshire. It, in conjunction with the millstone grit (the farewell rock of the Welsh miner) completely surrounds the great coal basin near Swansea. Detached portions are found at Pembroke, Monmouth, and along the right bank of the Severn near Newport. It is largely developed in Derbyshire, Lancashire, Yorkshire, Westmoreland, Cumberland, Northumberland, and Durham, Flint and Denbigh, North Wales; in the two last-named counties it is celebrated for containing great deposits of galena, or lead ore. This is the limestone which is so much employed for

agricultural purposes, building, and as a flux in smelting iron ores.

The millstone grit, which overlies the mountain limestone, is generally composed of small grains of sharp sand, sometimes containing fragments of felspar. This formation occupies a considerable space, having a very irregular outline from the southern part of Derby to near Newcastle-upon-Tyne. A pretty extensive area of this rock is also found in the northern part of Devon.

It is scarcely requisite to describe the coal-fields, as they are pretty well known, the principal ones being the Northumberland, Durham, Lancashire, York, and Derby—the three last were originally united—and the Staffordshire, Shropshire, and North Wales coal-fields.

Above the coal-fields are the new red sandstone and magnesian limestone beds, the former containing the celebrated mines of rock-salt, and the brine springs of Worcestershire and Cheshire. The red sandstone series is composed of alternate beds of soft sandstone, marls, and clays. In Lancashire, the magnesian limestone of the northern counties is replaced by a magnesian marl. Gypsum is often found in the new red sandstone, especially amongst the saliferous marls. This formation is most fully developed in Cheshire, Lancashire, Staffordshire, Salop, Warwick, and Worcester; and from Nottingham, through Doncaster to Newcastle-upon-Tyne, it is remarkable for being much covered with the boulder clay or northern drift.

The oolitic system, including the lias, forms a series of continuous, but intermixed bands of strata, extending from Dorchester through the centre of England to the German Ocean in the North Riding of Yorkshire. The lias is composed of two beds—the alum shales, and the lias clay. The alum shales are generally very unproductive; the lias clay, when well drained, forms good pasture land; but, owing to its adhesive heavy character, is unfit for arable husbandry. It is in these beds that the extraordinary saurian remains have been found so abundantly. The celebrated Vale of Cleveland, in the north of Yorkshire, is situate on the lias. Much of the heavy grazing lands of the midland counties, extending in a diagonal line, across the kingdom, from the neighbourhood of Lincoln to Gloucester, is composed of the lias formation.* Intermixed and adjoining to the lias is the oolitic series—so termed in consequence of its being composed of a limestone, which is formed of rounded pieces of carbonate of lime, aggregated like the roe of a fish. The soils on the oolitic limestone group possess a general character, being light, and occasionally springy, in conse-

* The lias group has at one period covered a much wider area than it does at present. Several detached but small outliers of the lias formation cap the hills in various parts of Shropshire—the great mass having been washed away by the same causes that swept away the red marls of the new red sandstone.

quence of thin beds of intervening clay causing springs to issue along the line of their outcrop. For a correct conception of the district occupied by this group, the reader must be referred to a geological map. An almost isolated district of some extent, composed of the oolitic group, is to be found in the north of Yorkshire, near Scarborough.

Intermixed with the light calcareous soils of the oolitic series is the stiff retentive Oxford and Kimmeridge clay, on which formation the soils are generally found as stiff and intractable in character as on the lias series. The Oxford clay extends from Lynn in Norfolk to Oxford and Berkshire, where it thins off, but reappears in Wilts and Dorset.

Superior to the oolitic group is the Wealden, which is principally developed in Sussex, Kent, Hampshire, and the borders of Surrey. The Wealden is composed of the Hastings—sometimes called the iron sands, in consequence of the presence of considerable quantities of oxide of iron amongst this part of the group—and the Weald clay.

The chalk series is the next order, and is composed of the lower greensand, the gault, the upper greensand, and the chalk, whose united outcrops occupy a very large part of England's surface, and form some of its most picturesque cliffs on the southern and south-eastern coasts. The chalk series is remarkable for containing in the beds of the upper greensand nodules of phosphate of lime, to which the term coprolites has been given. In the lower greensand these substances are not so abundant, notwithstanding which, so much is the phosphate of lime disseminated amongst it that the application of bones has very little fertilising influence. The lower greensand contains great quantities of oxide of iron, commonly used for repairing roads, but at former periods was extensively employed for the manufacture of iron, heaps of slags being still found in the vicinity of sheets of water, known usually under the name of hammer-ponds. At these smelting works, wood was the fuel employed. Notwithstanding the apparent unfertile aspect of the lower greensands, on few soils does timber, even the lordly oak, grow so freely. The gault clay is remarkably productive, and is the only strong soil belonging to the group. The greensand has obtained its name in consequence of being in some parts intermixed with small portions of disintegrated chlorite. This, however, is by no means a general feature. The chalk does not need any particular description, its usual character being known to all. It has undoubtedly been formed under the sea, principally by means of marine animalculæ, in the same manner that mountains of coralline limestone are now in progress of formation on the ancient submarine craters of the Pacific and Indian Oceans.

Above the chalk we arrive at the eocene deposits. This name is

given to the lowest division of the tertiary strata, containing an extremely small proportion of living species amongst its fossil shells, which indicate the first commencement or dawn of the existing state of the animate creation. It is derived from *Eos*, Aurora, or the dawn, and *Kainos*, recent. The lowest bed of the Eocene consists of the plastic clay, occasionally intermixed with beds of gravel, and alternating sands and clay. The London clay lies immediately above the plastic clay, and occupies an extensive district in Middlesex, Kent, Essex, Hertford, Berkshire, and Surrey, being cut off, by the upheaval of the chalk and greensand, from another extensive portion found in Dorset, Sussex, and Hants. The London clay is usually of a bluish or blackish colour, and contains a portion of calcareous matter. Beds of sandstone are sometimes found in it: the thickness varies considerably—from 50 or 80 to 700 feet.

A considerable part of the London clay is covered by the Bagshot sands. These sands and gravels consist of varied accumulations of fine sand and sharp flints, occasionally having intervening beds of clay. That the water which transported these beds possessed a powerful current, is shown by the huge blocks of an apparently altered greenstone, locally known by the name of "grey weathers." The origin of this ditritus, as well as that which is found on the London clay, will be considered at a subsequent part of the paper.

The miocene, so called because a minority of its fossil shells are referable to living species—from *Meion*, less, and *Kainos*—recent, is principally seen in the British Islands in the Isle of Wight.

The pliocene strata extend from Essex to the north-east of Norfolk; it is divided into the older and newer pliocene. This title is applied because the largest part of the fossil shells found in these beds are of recent species, the etymology being *Pleion*, more, and *Kainos*, recent.

The pliocene period may be termed the age of elephants and cetaceans, the most remarkable accumulations of which fossils have been found on the coast of Norfolk. The remains of the mastodon have recently been discovered in the mammiferous crag of Norfolk and Suffolk. Coprolites have been collected also on the shores of these counties, and used for the purpose of manufacturing superphosphate of lime.

Recently-formed alluvial lands are found on the embochures of many of our rivers, such as the Humber, and high up various streams, as in the flat districts of Montgomery and Shropshire, bordering on the upper part of the Severn. The mouths of the Avon, and other rivers in the south of England, are similarly characterised. The marsh lands of the fen districts partake of a mixed character of alluvial soil and peat.

The Diluvian or erratic deposits will be considered in the course of the following section, in which also the plutonic rocks, such as those found in the Cheviots, will be noticed.

General view of soils.—Soils may be viewed as connected or disconnected with the strata on which they rest. In the course of the preceding remarks respecting the general view of the strata composing the crust of the earth, the reader will observe that almost every series consists of a greater or less number of alternating beds of sand and clay, the basset or outcropping edges of which occupy a large portion of the earth's surface—circumstances highly favourable to that admixture of soils, which has long been theoretically held, as well as practically found, to be of much service in promoting fertility. Open sands becoming mixed with stiff clays, convert them into friable loams, or turnip soils; whilst an admixture of clay amongst sharp sands gives the latter a proper degree of adhesiveness. We cannot, therefore, be surprised to find that, other things being equal, the most favourable soils for the farmer are usually found at the junction of beds belonging to either different geological epochs, or of varied lithological character. The Vale of Aylesbury is a remarkable instance of a number of geological features combining to form a soil of the best quality, the greensand becoming intermixed with calcareous and aluminous matters washed from the chalk, the oolite, and the Oxford clay. In fact, along the whole of this band of the greensand, superior land is formed wherever it becomes mixed with washings from the cretaceous groups of the oolite and chalk, and the aluminous band of the Oxford clay and lias shales.

Among the oldest rocks—such as granite, slate, lower silurian and upper silurian, as far as the mudstones—the surface-soil partakes greatly of the character of the subjacent rock, the soils being silicious or aluminous, fertile or infertile, according to the more or less decomposable state of the rocks from which it is formed; the chemical character of its constituents in some places being highly fruitful, in others perfectly barren. The character of the slope and elevation will, however, greatly modify their character; for, if abrupt, a constant wasting will be going forward; and if elevated, the influence of climate will detract from any favourable fertilising influences arising from the continued reproduction of a fertile soil.

In the vicinity of Penzance there exists a belt of land, comprising about one thousand acres of extraordinary fertility, owing, as correctly pointed out by Dr Paris, to the decomposition of the adjoining greenstone rocks. Decomposing porphyry, (Elvan,) potash felspathic, and hornblende minerals, invariably produce rich soils. Owing to the circumstance of their position, the oldest rocks are necessarily dependent for the formation of their active soils on the amount of their own degradation; and it is not until we get tolerably high in the geological series that we are to look for any considerable formation of soils from the debris of pre-formed rocks. This rule does not universally apply, for Mr Trimmer has shown strong grounds for believing that the clay of the boulder or glacial

period has been, and now lies, deposited on the summit of Moel Tryfan, near the mouth of the Menai Straits, a mountain low in the silurian series. For practical purposes, however, it may be safely averred, that only very limited areas of soil have been formed by the deposition, on rocks of older age, of the debris from newer formations: In a word, the soils on the primitive districts are formed by the disintegration of their own rocks; and this remark applies also to the silurian formations generally, as well as to the old red sandstone. In fact, the origin of the soils on the latter formation is so well marked that the merest tyro would comprehend it at the first inspection.

In the carboniferous series, the mountain limestone is usually covered with a greater or less depth, according to circumstances, of a fine loam, admirably calculated for turnip husbandry. The origin of this soil is evidently, from its different chemical composition, foreign to the rock on which it rests; and there is some difficulty in fixing the precise cause of this deposit, whether from the decomposition of the slate and silurian rocks alone, or from the deposit of mud, arising from all the prior formations. Some parts of the soil which covers the mountain limestone appear to have the same character as the boulder clay.

Few more acceptable services could be rendered to geology, than a correct account of the origin of the superficial deposits, which have evidently been derived from some other source than the rocks which they at present overlie; for, strange as it may appear, geologists are better acquainted with the conditions attendant on the formation of the oldest sedimentary rocks, than with those recent deposits which form the fields on which our farmers toil. This anomaly has recently attracted the attention of some of our best geologists, and, it is to be hoped, will be vigorously followed up; for there can scarcely exist a doubt that a correct elucidation of the phenomena connected with the deposition of many of our soils, which are evidently transported from distant localities, would contribute greatly towards arriving at correct views of the most recent changes which the earth's surface has undergone. Farmers have great opportunities, as compared with persons in other professions, of contributing information on this particular point; and it is to be hoped that not many years will elapse before a sufficient number will have made themselves acquainted with the outlines of geology, so as to be enabled to institute a set of independent observations.

The soils on the millstone grit are also composed of the rocks which they overlie, and are consequently very arenaceous.

For practical purposes, the soils on the coal-measures and new red sandstone may be considered as of having generic origin, consisting in part of deposits arising from the denudation of some of the marls, sands, and shales of the coal-measures, intermixed in many

places with the boulder-clay and occasional beds of marl, evidently of lacustrine formation. The boulder-clay and erratic deposits, supposed to be in part the produce of Scandinavian and Cumbrian rocks, is more frequently found on the red-sandstone series rather than on the coal-measures. Where, however, the soil is deep, very little difference in the general character of the soil exists between that found on the coal-measures and the new red sandstone. In some parts of Yorkshire, a not inconsiderable breadth of soil on these formations is composed of a rich loam, like silt, covering the coal-measures, the magnesian limestone, and the new red sandstone alike, and forming one of the richest soils in the kingdom. The celebrated Pontefract Liquorice Garden is situate in the centre of the district under notice; its formation is probably due to two causes—viz., partly to the finer mud belonging to the northern drift, and partly to mud formed during the eruption of the trap-hills of the Cheviot range, and the basalt at the Giant's Causeway. In like manner, some of the richest grazing lands in Leicestershire appear to be formed of clay having its origin from the igneous rocks found in that county.

The soils on the oolitic and liasic group are evidently derived from the rocks which they overlie; and the same remarks apply to the Wealden formation.

In the chalk formation, the greensand, where the lower series covers an extensive area, the soils are evidently the produce of the subjacent rock. The upper greensand, however, which is so valuable as a phosphoric-bearing stratum, only crops out at a few places, and, as an area for tillage, is quite insignificant.

The more elevated portions of the chalk district possess a soil almost wholly composed of chalk and comminuted flints; in other places it is covered with a loam of good character, not unlike that which covers so considerable a breadth of the new red sandstone, and has probably had its origin from the same cause. In some cases the flints have a different character from those found in the chalk-beds, being analogous to those seen on the London clay.

The London clay is a fresh-water formation, exceedingly tenacious. It is much intermixed with flints from the chalk series, and also others of a different character, containing an appreciable amount of oxide of iron, which, on decomposing, gives origin to a fine friable red loam. These flinty substances have been derived from the Lickey and Rowley Hills, near Birmingham, which were probably contemporaneously erupted with the Malvern Rocks. Many of the sands and flints of Bagshot appear to have had a similar source.

The crag of the eastern counties has a varied soil, composed of the northern drift intermixed with the crag, and also blowing sands, which cover many parts of this and the chalk lands of that county, the sands being bound together by a black peaty substance, but

which, from the great intermixture of sand, usually passes under the improper denomination of black sand.

Peat or vegetable matter forms more or less a component part of all surface soils, and may be classed as the last geological change on the earth's surface. The power of apparently insignificant plants in facilitating geological changes, and at other times in exercising a conservative influence, is much greater than is ordinarily imagined. Lichens and mosses aid the atmosphere in decomposing the hardest rocks, which, when detached and washed away by torrents, are eventually deposited as portions of some newly-formed delta, contributing largely to its fertility, containing, as they do, the vegetable and mineral constituents requisite for new and higher orders of plants. But for the conservative influence of vegetation, clays and sands would be speedily washed into the sea.

On the plutonic or igneous-formed rocks, such as the Cheviots, the soil is generally formed by their decomposition, occasionally intermixed with peat. When drained, these soils are very fertile. Without that operation, all the igneous-rock formed soils support heavier cattle and sheep than sandy or light calcareous soils. The effect of other plutonic rocks in modifying the character of the active soils, is seen in the whin-dykes of the north of England, and the toad-stones of Derbyshire. The influence of the volcanic ash on the fertility of the soil in the west of England and the borders of Shropshire and Montgomery has been already noticed.

Manures adapted to different Soils.—Soils of a fruitful character will generally be found to possess the following qualities—viz., Moderate tenacity, such as loams; and are rich, comparatively speaking, in the mineral ingredients of plants; to which may be added the power of absorbing and retaining nitrogenised compounds, such as ammonia and its salts. These conditions will generally be found combined in a soil consisting of 65 parts sand, 25 parts alumina, and 10 parts of carbonaceous matter, commonly called humus; the remaining substances, minute in quantity, but powerful as fertilisers, being also requisite to make up a fertile soil; the latter consisting of small quantities of minerals, containing potash, phosphate of lime, and various amounts of common salt, lime, magnesia, &c.

The condition in which these latter substances may exist, is a point of some importance. For instance, strewing lumps of felspar, containing 16 per cent of potash, would no more add to the fertility of a soil than spreading an equal weight of brick-bats over the surface. Even when pounded, the action would be very slow, unless the mineral was one of facile decomposition. We need not, therefore, feel surprised that granitic soils are usually barren. Subsequent attrition, and the consequently greater exposed surface submitted to the action of aqueous and atmospheric influences, have

the power of slowly reducing the hardest minerals into a fine powder, which eventually gives rise to the first of our stratified deposits—clay-slate, in which form it again becomes indurated. In the course of the decomposition of granite, a considerable quantity of oxide of iron is set free, which, when mixed with the silicious and aluminous substances under notice, greatly aids a second decomposition. After the sedimentary deposits have become indurated, as in clay-slate, the presence of lime has a similar decomposing effect. It will, therefore, ever be found that hardened sedimentary, and even igneously formed rocks, are converted into soils the more rapidly the greater the amount of oxide of iron and lime that are contained in them. This power will of course vary, becoming less, in general, as the amount of silica is increased. All rocks, however, the decomposition of which is productive of fertile soils, contain the whole of the inorganic elements of plants. These may be in very small proportions, rarely exceeding 1 per cent, respectively, of potash and phosphate of lime. Where these proportions are increased, such soils are generally found to be extraordinarily fertile. An instance may be adduced in the case of some soils on the greensand near Farnham, the analysis of which is given, in the report of Professor Way and Mr Payne, of the phosphoritic strata of that district. Such a soil is found to have its productiveness increased solely by the application of nitrogenised manures. The celebrated rich soil already noticed near Penzance is fertile, owing to the presence of rapidly decomposing minerals containing potash.

All clays contain potash. Some, however, do not contain this substance in an available form—or, in other words, are of difficult solubility; for it should always be borne in remembrance, that, in order to become food for plants, the minerals must be converted first into a soluble form. On this subject, the experiments of Dr Daubeny, detailed in the Journal of the English Society, are exceedingly instructive.

I shall now allude to another point of importance respecting clays—the generally comparative infertility of soils containing the oxide of iron in the sesqui-oxide form. Such clays are usually of a buff or ochrey colour. The difference of colour is evidently owing to the lower state of oxidation; because, when these soils are subjected to the action of fire, as in burning land for manure, the ashes so formed are red, showing the higher state of oxidation into which it has become changed.

I strongly suspect that clays of the kind under notice owe their character in some degree to the formation of hydrated compounds of magnesia, lime, alumina, and oxide of iron, and occasionally, also, a combination with soda and potash; and I am unacquainted with any other mode of modifying the nature of these soils but that of burning. The Oxford and Kimmeridge clays are examples of this kind of soil. Magnesian clay soils have also a similar cha-

racter, being tenacious, and of difficult cultivation, on which draining and burning are very beneficial. Magnesian clays are, however, the most intractable.

Farmyard manure will be found of most beneficial application on loamy soils, whether those are sandy, calcareous, or mouldy; whilst portable manures will be found most conducive to fertility on open soils.

On the old red sandstone, except in deep vales, portable manures will be found most beneficial; and those on the lighter soils ought always to contain a portion of potash. As a general rule, clays usually contain as much potash as is converted into an active form in sufficient quantity for the growth of an ordinary crop, whenever phosphate of lime and azotised compounds are employed.

In the coal-measures are many beds containing fish-bones and potash in sufficient quantity to recommend their being applied as manure. As these shales generally contain as much carbon as will maintain a slow combustion, and also as much sulphur as will form a variable amount of sulphate of lime, it is evident that there exists, in many of the abandoned heaps of coal shales, a very valuable auxiliary manure.

To sum up, it will be found that, in deciding what manure should be applied to any soil, the mechanical condition, as well as the chemical composition, ought to be known. For instance, on the greensand, both lower and upper—also on the denuded beds of the chalk—phosphoric manures are completely worthless; and where a decomposing chlorite or felspar composes a considerable part of the soil, no other manure is found advantageous than those containing nitrogen. Sands, and calcareous sands and gravel, require potash, phosphate of lime, and nitrogen. Clays, according to circumstances, will do for some time without an application containing potash. On this description of soils, therefore, will the use of guano be found the most lasting; whilst the generality of silicious and calcareous soils of an arenaceous character will, in a short time, be reduced to a state of infertility, by merely using guano—as guano does not replace potash. Where, therefore, a farmer is in the habit of using both farmyard and portable manures, the farmyard manure should be applied to those soils which are deficient in one or more of the ingredients of the crop; whilst bones and guano will be found to answer on his stiff soils containing potash. Already, on arenaceous soils and peats, a repetition of guano has been found valueless. Not more than three crops have been taken, in many instances, since that fertiliser has been introduced.

Aptitude of different subsoils for different kinds of drainage.—Much of the character of both soils and subsoils, so far as regards their adaptation to peculiar kinds of drainage, is dependent on climate; for a clay, in a district where the rainfall is 50 inches per annum, requires a very different system to that where the rainfall is only 20 inches. Deep-draining may be found admirably cal-

culated for the latter, but certainly not for the former. I believe cases exist where drains beyond a depth of 24 inches will be found quite inadequate; whereas a depth of 40 or 50 inches might advantageously be adopted in a climate such as that of Essex, and this on soils exactly similar in all their characters. Stiff clays, composed in part of magnesia, cannot be effectually drained by deep drains: shallow ones, at narrow intervals, is the system which ought to be adopted on such soils.

The reason for this variance is very obvious. In dry climates, the speedier evaporation of the water causes the clay to crack; through which fissures the water quickly finds its way to the drains. In wet districts, however, such dryness as will permit the fissuring of the soil does not take place; consequently, the drain only takes away the water immediately contiguous to it. Deep-draining has been found a complete failure in the wet districts of Cumberland, as might have easily been foreseen by any who would exercise only a moderate amount of their reasoning faculties. The proper depth of drains on retentive soils can only be ascertained by considerable local knowledge, and a due attention to climate. A depth that can be safely adopted in the southern counties would be useless in the moist climates of the west of England, Wales, and the northern counties. It ought always to be kept in remembrance, that in these wet districts the land is more profitable, under a proper system of grazing, than in arable husbandry.* There is a description of subsoil known as "till," on which shallow-draining is usually preferable to deep-draining. This is partly owing to the character of the till, and partly owing to the circumstance that the shallow active soil, which usually covers the till, is usually separated from the latter by a thin space, which in rainy weather is occupied by a sheet of water: this, by capillary attraction, is retained in its position with some force, and consequently prevents any drying action taking place on the subsoil. In cases where it may be otherwise considered advisable to drain deep in "*till*," the subsoil-plough should invariably be so used as to intermix, as much as possible, the active soil with the subsoil. The term "till" is used in the agricultural, not the geological meaning.†

Where light sands underlie a soil of stiffer character, as sometimes is the case, Elkington's mode of draining may occasionally be adopted. In doing so, however, a careful survey should be made as to the bearing of the outcrop—otherwise, if proper precautions are not used, more valuable lands, at a lower elevation, may be con-

* The late wet season has abundantly proved the correctness of the above remarks, it having been observed, in some instances, that from the deep drains on heavy clay soils in the south of England less water has issued than usual.

† "*Till*," in geology, means the boulder clay; the *till* here alluded to is often termed "Moorland Pan."

verted into a marsh. In such cases, a knowledge of geology will be found highly serviceable.

Where soils and subsoils are light calcareous, or arenaceous sands, deep-draining will be usually found more beneficial than shallow-draining.* The like remark also applies where the underlying stratum is a porous sandstone chalk, at a moderate depth.

Crops adapted to different soils.—The most appropriate crops on heavy soils are beans, cabbages, and rape; whilst in dry climates, such as Essex, Hereford, Kent, &c., wheat can generally be advantageously grown. The great drawback on the cultivation of heavy clay soils is the amount of animal power required for their cultivation, which is the more enhanced the moister the climate. For this reason, strong soils will usually be found most profitable under grass. The great disadvantage of grass-lands is the small amount of winter food which they produce. The application of a cheap mineral silicate as a top-dressing, mixed with guano, would enable the farmer to take two crops of hay in the course of the year, and leave the aftermath in a better state than under the present system. A small portion of each clay farm might be kept under cultivation for the purpose of using the manure formed on the farm, by which straw for bedding and some roots could be grown. A course of this description would be admirably adapted for all heavy clays, such as the lias, London, and Oxford clays. If previously drained and dressed as described, the pastures and meadows would annually become more valuable, and, in consequence of the increasing thickness of the sward, would be constantly becoming drier, and have less of that *cold* character, forming so great a characteristic of our clay lands. Many clay soils, by this means, could be converted into almost as rich grazing lands as those of Lincolnshire, Endsleigh, or Aylesbury. These latter are valuable only because they are made such by natural causes, whilst the same thing can be promoted by artificial ones. Even these celebrated pastures might be made more profitable, by in part taking hay for winter use—repairing the loss of fertility thus occasioned by a top-dressing. The increasing scarcity of store-cattle is an additional reason why this recommendation should be adopted.

On the silurian and clay-slate rocks, turnips, rape, barley, and oats may be taken, with alternating crops of hay and pasture, varying according to elevation and climate. The superior altitudes must, however, be for ever used as sheep-walks, and as pasturage grounds for rearing young cattle.

The old red sandstone is calculated for every description of husbandry ; but in the vales, particularly for carrots and turnips. The lighter lands on the hill-sides will produce good crops of barley

* For an excellent article on this subject, see a paper by H. S. Thompson, Esq., *Journal of the English Society*, vol. ii. p. 27.

and turnips: the more elevated parts are only fit for sheep-walks, the herbage not being sufficiently strong for rearing store-cattle. This formation and all the light lands are well calculated for the growth of flax—a crop now occupying so much attention—which, if pulled for virgin flax, and dew-retted on pasture, no injury would occur to the farm on which it is grown. The greensand formation is admirably calculated for the growth of this crop—barley, clover, turnips, and carrots.

The oolite, including the Portland oolite, great oolite, and coral rag, are soils which might by artificial means be made much more productive either as arable or pasture lands. Large areas are at present only occupied as sheep-walks. They might be made to yield large returns by what is termed high-farming, though it would not be expedient to keep too large a portion of farms on these rocks under arable cultivation, for they suffer much during seasons of drought. Pasture land in good heart suffers less from drought than any other farming produce. These, as well as the chalk, are well adapted for the production of flax.

To sum up: The whole of the soils of the kingdom may be divided into three classes—heavy lands, loams, and light soils. The former, in the vast majority of cases, will recompense the farmer and the landlord the best, whilst in pasture, if well managed. A Northampton farmer, with his six-horse team employed in fallowing, will perhaps express a different opinion; but summing up the expenses and receipts for a number of years will show that, in Northamptonshire, farmers would make more money by an increased and judicious mixture of pasture, over their present arable system on strong clays.

Loams, which are medium soils between light lands and stiff clays, may generally be converted to either pasture or arable land without much affecting the farmer's gains. Generally, however, more money is made on such soils by arable than pasture farming. It is, however, impossible to lay down absolute rules, because cases will greatly vary as regards the demand for particular kinds of produce, according to the situation of markets, &c. All that can at present be recommended is to lay down general rules.

Chalk is best adapted for sainfoin, clovers, pease, and flax; particularly those districts on the chalk which have a moderate covering of red loam.

The weald clays and sand fall under the same generic rules which apply to light and heavy soils: these have been already noticed.

The crag, like the greensand, is not benefited by the application of bones.

Peats are much improved by being dressed with lime; and one of the most useful purposes to which geology can be applied in agriculture, is the detection of limestone beds that can be made useful for agricultural purposes. A lavish or indiscriminate use of lime is, however, to be deprecated.

THE SALMON—ITS PRESERVATION AND INCREASE.

ALTHOUGH the salmon is the most delightful of our river fish, and the only one of any commercial value, it was only in 1833 that its true history began to be ascertained; and though its numbers and value are every year diminishing from various causes, and its extinction even begins to be apprehended, no steps are taken for its preservation or increase, except such steps as prior to 1833 were taken to ascertain its history—that is to say, steps of no value.

It is true that, as early as 1686, the English naturalist Ray gave out some opinions that showed he had to a certain extent studied the subject, but they were of no value; and from that period, for the space of about 140 years, writers on natural history, including some men otherwise considered men of science, followed one another in opinions which actual investigation has shown to be utterly and almost incomprehensibly absurd.

It was on the 11th July 1833 that Mr John Shaw, residing at Drumlanrig, in the unpretending situation of Forester to the Duke of Buccleuch, began his investigations; and carried them to an issue so conclusive, and almost wonderful, that from the close of his labours in 1838, and their publication in the Hall, and afterwards in the Transactions of the Royal Society of Scotland in 1840, there has not been, and there cannot be, a dissenting word.

Up to that period the *parr* was considered a distinct fish; and the *smoult* was considered the fry of the salmon, in its first year—supposed to grow with a rapidity that ought to have appeared incredible;—for it was supposed to be hatched in the early spring, though it was hardly known of what size; to appear all of a sudden about May, as a *smoult*, which was acknowledged to be the young of salmon, of several ounces; then to go down to the sea, and return in July and August a grilse of eight and ten pounds, and next year to return a salmon of twenty or thirty pounds, and after that of greater size and weight, according to its years!

Mr Shaw has put an end to that romance. He has not only followed this valuable fish, from its extrusion from the egg, amid the horses' hoofs, and under the cart-wheels of the ignorant Rustic, to its perfecting as a salmon; but, to render cavil impossible, he has even caused the fish to be procreated in his presence, and under his own hands. He has in this way shown it in the egg of the parent fish; he has shown it extruded, a weak and almost shadowy creature, of the very feeblest nature, and carrying at its breast the vesicle whence it for a time derives its nourishment. He has then shown it lurking in the quiet waters in the margins of rivers, and even in that procured by the indentation of a horse's hoof—a little, nimble, but delicate creature, about an inch long. He has

shown it in 4 months a *parr*, clearly developed, though of small size; in six months a parr of about 3 or 3½ inches; and so continuing till next spring, as during the cold of winter the progress in growth is not great. At 18 months the parr is of six inches; and then considered a fit subject for the sport of the angler; and, up to that period, ignorantly abandoned to him, or to any other, *as a fish of no value, and in which the proprietors of salmon were not interested!* What ultimately became of this neglected fish, was not till this time known or inquired; it was only generally understood to disappear with the smoults. But Mr Shaw has clearly shown it to be, after its second year, *transformed into the smoult, the acknowledged young of salmon*; to be then seized with the migratory *estus*, and descend into the sea; to return thence a *grilse*, of 8, 10, and even 15 and 16 lb.; and in the next year to be changed into a salmon.

Mr Shaw showed all this, first by removing the fecundated spawn of the salmon from the bed of the river in which it had been deposited, and bringing it to the state of *parr*, in a separate pond. And it being still questioned whether the spawn he had thus removed was that of the salmon, and not of the parr, he made the truth of his assertion patent to all time, by seizing the female salmon in the act of depositing her eggs, and by pressure on her abdomen, causing her to complete that operation; and next by, in like manner, seizing and pressing the male, and causing him to fecundate the thus extruded eggs of the female. He then carried the spawn so obtained to a pond of the proper depth, pervaded by a stream of spring water and separated from the river, and in that watched the hatching and growth of the fish, *first into the parr, and then into the smoult;* and then, after in their efforts to escape many of the smoults had thrown themselves on the bank and died, allowing them to descend into the sea, and so complete the phases of their existence.

In this way the history of the fish has been developed, to *a certain stage*, in a manner so complete as to leave nothing wanting. Many have been benefited by his information; and *the country* might to a large extent be enriched by carrying out measures which Mr Shaw's experiments obviously suggest. But nothing has been done. The parties whose interests are in the first instance concerned, instead of endeavouring to increase the numbers of the fish, *by seconding nature* in the management of the rivers, have only continued their old plans of "Beggar my neighbour," in utter disregard of the increase, or even continuance, of the fish. In this we refer, of course, to the proprietors of the mouths of the rivers, and all in succession up to the breeding grounds. We cannot expect that, in face of this example, the ignorant and mischievous clowns on the banks of the rivers should behave better; but we *are* surprised that the editor or proprietors of the once famous

Edinburgh Review, ignorant themselves, as the world in general was up to Mr Shaw's experiments, should have experienced no nobler feeling towards him than to *sneer* at "the practical man;" and, because he has not yet followed, or perhaps never may be able to follow, his *elèves* into the sea, and record their fortunes *there*, say that *we know nothing;* that "the practical man" has taught nothing;—with just as great truth and justice as we might say, that because we cannot follow a Reviewer to heaven, or to any other more suitable *habitat*, after closing his labours here on earth, we know nothing of him—"the practical man" has taught nothing! It will not, after this, be surprising to find, that the *recommendations as to the management of the fishings*, the only pretence for publishing some twenty pages of alternate bounces and sneers, is stolen, "body and bones," from a country clergyman, namely, the Rev. D. S. Williamson, minister of Tongland; whose paper upon the subject appears to have been written in 1840, and published in 1843, while this article in the review is only of April 1851.

But perhaps Mr Shaw has been enrolled among our practical philosophers?—or at least made an *emeritus socius*, or something attesting the respect of men of science for him and for his labours? I doubt if anything of all this has happened; though from the importance, and decision, and even ingenuity of his experiments, he has shamed them all; and better deserves to stand next to the immortal *Printer* and *Electrician** than any who at present does—save and except, perhaps, the *Glasgow watchmaker*, or the *brother mechanic*, that adapted his invention to the propelling of vessels at sea. Certainly Government has not bestowed on Mr Shaw any mark of favour; nor, what would more have pleased him, perhaps, encouraged in any way to the following up of his labours. All the distinction he has received has been, that the Royal Society has printed his researches, and accompanied them by very beautiful prints of the objects he had communicated along with them.

An ingenious northern baronet, indeed, (I think of Gairloch or Coul,) did Mr Shaw the honour to construct ponds upon his principle, with a view to *increasing the breed of fish;* while Mr Shaw's experiments were directed ostensibly to identifying the parr with the smoult. In this way the honour has been secured to Scotland, both of elucidating the history of the salmon, and of showing the way to its increase; and we shall see, by and by, that both points are of some consequence. The spirited Northern had not, perhaps, succeeded materially, or his plan would have been adopted by others, which, I believe, has not happened. But all in good time. Perhaps he did not consult Mr Shaw, nor seek his assistance, and so he has more or less failed. If this be so, it is to be regretted. An invention of any kind is ruined by the unskilful

* Franklin.

adoption of it; because most people are satisfied with concluding, that if an invention does not succeed *in any hands*, it does not deserve to succeed.

Something like this, at least, or something less creditable still, (an unpardonable apathy,) must be held to account for the fact, that the plans of Mr Shaw—or, at least, the plans which they obviously suggest, and the circumstances of the fishings seem to render invaluable—have hitherto been useless. Neither public patronage nor private enterprise have led to any adoption, or even recommendation, of Mr Shaw's plans; and therefore they have been barren for twelve years.

"They manage *these things* differently in France," whatever we may think of their management in general.

It may not be generally known (says a French paper of the other day) that the means of producing fish to an incalculable extent, in lakes and rivers, have been discovered, and have, within the last *three years*, been employed on a grand scale, and with extraordinary success in different parts of France.

Some years ago two fishermen, named Gehin and Remy, of *la Bresse*, in the department of the Vosges, found that, from various causes, the stock of trout, for which the rivers and lakes of that department are famous, had greatly declined; and they attentively studied the habits of the male and female trout at spawning-time, with the view, if possible, of discovering the means of checking the evil.

After long and patient observation, they found that not one in a hundred of the eggs deposited by the female in the bed of rivers, and fecundated by the milt of the male, came to maturity—the rest being devoured by other fish, washed away, or destroyed by mud. They found, also, that of the fish which had become extruded, or hatched, the greater part were destroyed by the large fish of their own or different species.

It then struck them, that if they were *to collect the eggs, and apply the milt themselves, instead of leaving the fish to do it*, and afterwards to secure the young fish from the voracity of the larger ones, they would, in the course of a few years, obtain an inexhaustible supply. Accordingly, they seized a female trout, just as they perceived she was about to spawn, and by pressure on her belly, caused her to deposit her eggs in a vessel containing fresh water. They afterwards took a male, and by pressing his belly in the same way, caused his milt to spout on the eggs. It is by pressure on the belly that the female and male always relieve themselves at spawning-time. These two men, then, in imitation of the fish, placed the eggs in a layer of gravel, which they had deposited in a box full of holes. This box they fixed in the bed of a flowing stream, and covered it with pebbles. The fish themselves, in the natural way, cover the eggs with pebbles, and leave them. In due time the eggs extruded, and every one was found to be good. They thus obtained from one female several hundred fish. They took precautions for keeping the little creatures in water where they were out of danger, and supplied them with fitting food. Applying this operation, the year after, to a great number of fish, they obtained several thousand trout; and, in a year or two more, the numbers had literally increased to millions. After they had stocked all the rivers and streams of the Vosges, and some in the Moselle, and the Haut and Bas Rhin, Dr Haxo, Secretary of the *Société d'Emulation des Vosges*, drew the attention of the Academy of Science, and of the Government, to the discovery. The Academy declared that it was of *immense national importance*, though it had long been known to scientific men as a scientific curiosity, but not as a practical utility. The Government, on its part, saw that the application of it to the rivers and streams of France would not only afford employment to a vast number of persons, but would enable an immense addition to be made, at scarcely any expense, to the people's food. It accordingly *took the two men into its service, and made them apply the system to different waters*. They have done so with the most singular success. Rivers and lakes in which there were no fish are now teeming with them. Nor have they confined their operations to trout alone, but have

extended them to *salmon, tench,* and *perch,* and in each case with complete success. Indeed, their system is applicable to all sorts of fresh-water fish, and to those which, after spawning in rivers, descend to the sea.

Among the rivers which they have already stocked, are those of Isere, Haute-Loire, Allière, Lozière, Meuse, Meurthe, and the Haute-Solne. *Several gentlemen of property* have also tried the system, with success, on their estates in Burgundy, Brie, and Normandy. In addition to the breeding of fish in enormous quantities, it enables to naturalise fish of different species in strange waters, or to remove them from river to river. *So great is the importance which the Government attaches to the plan, that it has nominated a commission of eminent men to superintend the operations of Gehin and Remy.* The *Moniteur* announces that the Minister of Marine and Colonies has also ordered that experiments shall be made to apply it to *salt-water fish, at the mouth of rivers, and off the coasts,* and especially to lobsters. M. Valenciennes, an eminent icthyologist, and member of the Institute, has been charged to examine the mouths of rivers, and the coasts from Havre to La-Teste, and to state in what places the experiments may be tried with advantage. M. Milne Edwards, and M. Costo, both members of the Institute, have been directed to make similar investigations between Cherbourg and Granville, and in the environs of Trouville.

Here is a country that, we should say, deserves to thrive; not a country that looks to no internal resources, except mere private enterprise shall stumble upon them and find the means of carrying them out; where there is no public encouragement or protection.

The first observation upon the above is, that the French Savans have not been able to resist asserting that they knew all about breeding fish before, although they had never dreamt of turning it into "a practical utility." From that acknowledgment, they had better have said nothing about it.

Next, *how did they know it?* Mr Shaw's papers, both upon that and the sea-trout, and also the papers of another equally "practical" observer, following in the steps of Mr Shaw, (Mr Young, manager for the Duke of Sutherland at Loch-Shin,) have been before the world since 1840–41, in the Transactions of the Royal Society of Scotland; and that in conjunction with essays, that must have led the volumes into France; for they are essays upon Scottish subjects by *French Savans.*

We think it highly probable, therefore, that though the French philosophers themselves took no steps in the matter, *it would be impossible for them not to talk of it—and talk of it to fishermen too;* and hence, most certainly, after nine years, the resort of these fishermen to Mr Shaw's plans. It is almost impossible that these fishermen should at once have jumped to the conclusion which Mr Shaw arrived at only by slow degrees; and *by being pressed to establish the fact,* that the spawn he had taken from the river, when producing the parr, *was the spawn of salmon.* It was then only that he took to a plan that seems almost miracle-working; namely, imitating by human agency the creative power of nature; and Mr Shaw resorted to it with little hope, but as a desperate endeavour to put cavillers to silence. But it would seem by the story to have *at once* struck the French fishermen, "*to collect the eggs and apply the milt themselves, instead of leaving the fish to do it;*"—a

marvellous stretch of ingenuity at once, and in which they probably would not succeed; for the female fish, perhaps, never extrude their eggs naturally, without the presence of a male either young or old; and, consequently, these *egg-gatherers*, though they may have done no harm by subsequently applying the milt, were probably behindhand. But this is probably only a wrong description of what they did; for the *operation of these men*, as afterwards described, is precisely the operation of Mr Shaw. "They seized a female, just as they perceived she was about to spawn, and by pressure on her belly, caused her to deposit her eggs in a vessel containing fresh water; and afterwards took a male, and by pressing his belly in the same way, caused his milt to spurt upon the eggs." Be this as it may, their idea was precisely that of Mr Shaw, only less intelligently followed up; for *he* only applied the milt, either when he *saw that no male was present*, or when he himself forcibly extruded the eggs.

The reasons of these men for acting were perfectly correct—namely, "to prevent the spawn or the young fish from being devoured by other fish, washed away, or destroyed by mud;"—and their *modus operandi* was at once efficient and inexpensive. "In imitation of the fish, they placed the eggs in a layer of gravel, which they (had) deposited in a box full of holes,"—meaning, it must be inferred, at the two ends; and leaving a sufficiency of solid wood at the bottom to keep a due depth of gravel stationary.

"This box they fixed in the bed of a flowing stream, and *covered it with pebbles.*" It is to be feared that here again the description is imperfect; for if the box had not *a run of water*, *however gentle*, *through it and over the fish*, nature would not be imitated, and the spawn would perish; and for this the box must have a void space.

This is another point in the theory which a Scotchman and a "practical man" has had the good fortune to establish, by a very decisive experiment—Mr Young, manager for the Duke of Sutherland at Loch-Shin. "I have this winter," says he, (referring to 1842,) "been trying to test the fact," (namely, whether the spawn would prosper in still water,) "in the following manner: At the same time that I deposited the spawn, from which I made my other experiments," (viz. in running water,) "I also placed a basket of the same spawn, with equal care, in a pool of pure still water, from the river Shin; and I soon found that, while that which was placed *in the running pools* was regularly progressing, *every particle put into the still water was as visibly degenerating;* so that by the time the spawn in the running pools was *alive*, *that in the still water was a rotten mass.*" From this, and from the slightest consideration of the natural state of matters, two things are plain; namely, that while the spawn in its bed must be *at rest*, it must at the same time have the *ever-changing water running over it.* It may be observed, that a *basket*, as used by Mr Young, would seem a very proper sub-

stitute for the box used by the Frenchmen, provided it were firmly anchored, and a few inches at the bottom so close as to prevent any probable disturbance of the spawn.

The next thing to be observed is, that these fishermen bestowed all this trouble upon *mere river trout*, and even stocked several rivers, apparently *with no ulterior view*, unless it may have been of enjoying their share of the fishing along with others; while WE have the valuable salmon to encourage us, and entire possession of the produce, at least to the proprietors of the banks of the streams; yet no effort has been made by *us*, not even by *amateur fishers;* who are so stupid as to waste their lives watching for "nibbles," when, by a little intelligent trouble to increase the breed of the fish, they might be nightly returning with their baskets full.

But the most to be wondered at are the *Landlords*, and after them the *Government*.

The report as to the labours of these humble fishermen is, that having taken precautions "for keeping the little creatures in water where they were out of danger," (*where that was*, in the bed of a river, it is not easy to conjecture; but Mr Shaw's side-ponds make the matter very distinct;) "and also supplied them with fitting food," (Mr Shaw merely sends over them a stream, "in which the *larvæ* of insects abound,") "in a year or two the numbers had literally increased to millions;" and "after they had stocked all the rivers and streams of the Vosges," (their paymasters and probable profits never mentioned,) "and some in the Moselle and Haut and Bas-Rhin,"—what happened? "Dr Haxo, secretary of the *Société d'Emulation des Vosges*, drew the attention of *the Academy of Science and of the Government to the discovery*. The Academy declared that it" (meaning this discovery, even as to the multiplying of *mere trout*,) "was of *immense national importance. The Government, on its part*, saw that the application of it to the rivers and streams of France would not only *afford employment to a vast number of persons, but would enable an immense addition to be made*, at *scarcely any expense, to the food of the people.* It accordingly took the two men into its service, and made them apply the system to different waters. They have done so with the most singular success: rivers and lakes, in which there were no fish, are now teeming with them." "A commission of eminent men has been nominated to superintend the operations of Gehin and Remy;" and the breeding of fish in the lakes and rivers will speedily be as habitual a source of employment and profit in France, as the growing of corn in the fields—and as properly.

England! with all thy faults I love thee still,

said one of her mad poets; and he has been "applauded to the very echo" for that *particularly patriotic line.* She must take care that some poetical cobbler does not find it necessary, considering all

things—the implasticity of her men of science, the inertness of her Government, and the utter stolidity of some others—to exclaim,

England! you are a dunce, and ever will.

These humble French fishermen *knew* that, if they succeeded in their experiments, they would be patronised, employed, rewarded! —just as certainly as a French trumpeter knew, and perhaps still knows, that he may aspire to a Marshal's truncheon. But woe to the British aspirant to distinction or utility! He will in the first place *lose his credit*, as a speculative person—he may rely upon that; and if he succeeds, this is his fortune: His neighbour will appropriate his invention, and glory in robbing him of all reward—(See the case of Henry Bell in Scotland, and Hargraves and Radcliffe in England;)—and the Government will look on like a hazy Lord Chancellor, as if injustice to the ingenious were the normal state of Britain. It happens, in consequence, that unless a man has the good fortune to be born a Prince, he may preach of improvements to the end of time, and no one will regard him; and he that has been born to be a Forester, however ingenious, will be left to remain a Forester still.

I would wish "to alter all this;" and, at all events, to alter the state of things as to *salmon*.

I have spoken, up to this point, of multiplying the young of salmon, as to which both the experiments of Mr Shaw and the practice of the French fishermen supply valuable hints; though Mr Shaw's experiments were not entered upon with that view, but merely to show, as I have said, that *the parr* and *the smoult* are salmon in different stages, just as *the grilse* is.

The plans of the French fishermen have one great recommendation—they are inexpensive; so inexpensive, that they may be adopted extensively, without much regard to their always succeeding. For example, breeding-baskets may be put down in many places, promising to keep "the little creatures out of danger," and also likely to "supply them with fitting food," though changes in the bed of the river may disappoint the intention, because the expense would not be great. If boxes are to be put down, they should of course be strong, and secure beyond any probable chance of removal. They should be covered during the period of hatching, (from 90 to 100, 108, or 130 days, according to the temperature of the river at the spot,) and in the neighbourhood of comparatively still water, if artificially stilled for their use. Perhaps the water should not only be artificially stilled, but so enclosed that other fish would not in any probability break in, or with refuges which the little creatures might seek, (for they are very nimble and dexterous,) and larger fish could not enter.

But the best assurance would seem to be *breeding-ponds*, either

open for the parent fish to enter and leave, and upon their leaving, being shut up, except as to the entrance and exit of an offtake from the river or some other stream; or ponds into which the spawn should be carried, either when taken from the fish or from the river.

If the breeding-ponds were left open at the two ends, or at least at the lower end, the fish would certainly seek *their own pond.* This begins to be questioned; but *this*, at least, is undoubted, that when fish have been bred in pools and rivers that have afterwards been cut off from communication by accumulations of stones and shingle, the fish have been known to destroy themselves, by casting themselves upon the obstruction that lay between them and their native water, in their endeavours to reach it! Therefore, (though I shall not recommend this,) it seems extremely probable, that every proprietor along the banks of a river might construct his own pond, in the certainty that his own fish would return to him if permitted.

Without any reference to this, however, it is probable that every proprietor should give space for a breeding-pond, or in some way or other be a breeder. I will indicate some of the many ways in which it might be promoted before closing.

But the promotion of the breeding of the fish is not all that is required. In the larger rivers, in particular, and in all the rivers more or less, the fish are liable to many casualties.

It is much complained that manufacturing establishments, by sending their poisonous waters into rivers, extensively destroy the fish, or, by making the water unpleasant, at least injure the fishings. It may be that the interest of a proprietor in salmon-fishings as at present conducted, may be very inferior to his interest in the sites of manufactories; and it may be that his neighbours, or rather joint-proprietors of the river, cannot prevent him sending whatever he pleases into the stream. But this seems doubtful; for there appears to be little distinction between poisoning the waters of a river and the waters of a well; and, at least, it will be admitted that, if manufactures could be conducted without injuriously affecting the waters of the rivers, it would be desirable; and science has now made such advances that it seems perfectly possible, many of the ejecta of factories that are at present poisonous, might, with proper care, not only be deprived of their noxious qualities before reaching the rivers, but be made useful to more than the extent of the trouble bestowed upon them, as fertilisers of the soil; for the waters hold nothing in solution, but merely in suspension. This, at least, is a matter well worth considering.

Again, by tunnels, or ducts of some description, deleterious matters might be passed *under* valuable fishing rivers, and conducted to outlets where they can do no harm.

Farther, it has been supposed that the fish are disturbed by the steam-paddle.

I have long entertained this impression, and that it has acted by *concussion;* and now I think I am able to adduce some evidence in aid.

Mr Shaw had been watching the spawning of sea-trout, and on 1st November 1839 caught a pair in the act. He very much desired to secure them, but had no means. On the spur of the moment, it occurred to him that he might use his fowling-piece, and by firing over them, *stun them without killing them*, as they were only about six inches under water. He fired across their heads accordingly, and *secured them both*, "not by the action of the shot upon the fish, but *by the concussion of the water*." I think this must demonstrate, very clearly, how injurious must be the perpetual flapping of paddle-wheels. It must disturb the fish extensively—perhaps directly injure them by concussion; and as there is now an opportunity of putting an end to the annoyance, it doubtless should be so. I think the *swirl* produced by the *screw* would be much less injurious. It would more resemble the natural current of the river. It is true, if a fish were caught in the screw, it might not only disturb, but destroy it; but for this it must be in the near neighbourhood of the screw. Fish see as well as feel, and they would see enough of the advancing vessel and her sequelæ to escape with ease from their near neighbourhood; but the stroke of the paddle-wheel must disturb at a great distance.

Otters would soon be disposed of, were a price paid for them; and so might pike and eel. So even might seals and porpoises, to a large extent; and, what appears a no less destructive enemy, at least of the descending fry—the saith or coal-fish. It appears this fish is voracious of the smoult, five or six of the latter having been found in the paunch of one. I think both the saith and a congener—the lyth—go in shoals, and near the surface, and might be easily bagged by a nett; or, by hook-and-line, gaffs, &c., either thinned or driven off the coast. The saith and lyth are, if not very valuable, at least very agreeable; and consequently fishings of these might be encouraged wherever they appeared; and seals and porpoises, dog-fish, every species of fish, however useless as food or for oil, may now be rendered valuable for manure; for which the railroad is ready to receive them night and day.

Fish will not enter a river without "a leading water." It is possible even their experience tells them they need not, because they could not reach their spawning-ground. If so, then, *pari ratione*, were spawning-beds provided near the mouths of rivers, they would enter at all seasons.

It is now generally understood—for I see writers are beginning to follow each other in the new plausibilities, just as they did in the old absurdities;—well, it is now generally understood, that if fish are prevented entering rivers when the wish is upon them,

they will, as when prevented descending the rivers, after a certain period, decline and die. This seems very probable; and the detention at the rivers' mouths, certainly exposes them to the attacks of their numerous enemies there.

I fear what I am now about to suggest as a corrective of this must be considered as carrying speculation too far. But Mr Williamson writes thus: "It is well known that salmon do not travel in dry weather. Before they ascend a river, they require a 'leading water.' They persist in hovering about the estuary, ascending with the tide; but, unless there be a *fresh* in the river, retiring with it; and, what is very strange, however low the river may have sunk, no sooner does it become quickened by a heavy fall of rain, than they rush into it in shoals, run up with great vivacity, and are taken many miles from the sea in the course of a few hours. It is evident, therefore, that a dry summer, though fatal to fisheries above high-water mark, is eminently favourable to those below it; and the more so, the closer the approximation to the sea."

Were the interests in the fishings consolidated, the ascending of the fish with the tide might be sufficient; but if not, it many times rains at the river-heads, without raining at the mouths; therefore, all that would be required to induce the fish to *run up* must be to feel that there is a flood in the river. Suppose all the proprietors of a river to combine for its management, in the case of manageable rivers—that is, the minor rivers—I think it might be easy to have considerable reservoirs, that, in the case of extreme visitations of drought at the season when it were desirable the fish should move, might be let out, and supply for a time an artificial flood. It is acknowledged on all hands that the fish run with extreme vivacity; and, even when the stream is very winding, will run thirty or forty miles in a couple of hours. A reservoir of no great extent might maintain a considerable current for the time; and there is hardly a river in Scotland that might not be made permanently more considerable, were its head-waters properly collected and sent to it.

Should the interests of petty mill-owners, &c., along the banks of rivers, prevent the removal of weirs, or rocks acting as weirs, and consequently the absolute reduction of heavy leaps, every proprietor would be entitled to do this—namely, to divide the leaps, by forming a basin at half the height, whence the subsequent leap could be taken.

Draining the land on the banks of rivers is said to have injured them as fishing rivers, by destroying their equability; that is, before the draining, the rain that fell on the land found its way to the rivers with difficulty, and so kept the streams equable for long; now it finds its way to the rivers at once, and consequently causes a heavy flow at once—but that over, leaves the rivers habitually low.

If this is so, it cannot be helped, and is not to be regretted; or it might be amended, by paying some attention to the channel and banks. The Clyde is one of the industrial glories of Scotland—its chief and almost only one of the description. By confining the stream, the water of the river has not only been made more available in the absence of the tide, but the tide flows with a depth and promptitude that could scarcely have been anticipated before the effect of removing the side-leaks was seen; and of course remains of a proper depth, correspondingly long. Upon the same principle, many other rivers might be much improved, either for the purposes of navigation or of floating timber, or, at all events, for the habitual passage of fish. At present, except the Clyde, the banks of almost all the rivers in Scotland are in a slovenly state; and *it* has only been cared for from Glasgow to the Firth. Much excellent land might be reclaimed on the banks of almost all the rivers, with much less to dread from floods than in the Continental rivers; and, particularly, their fisheries might in this way be rendered more productive, to the great profit of their Owners and the State.

I think, for the purpose of increasing the breed of fish, side-ponds should be formed in many places. They might be formed anywhere, (a communication with the river being secured,) and therefore be most profitable ornaments in the neighbourhood of gentlemen's houses or in their grounds, being obviously widely different in their objects and utility, from ordinary fish-ponds. The latter can be only objects of pleasure; these salmon-beds would have a tendency to most important profits. They must (according to Mr Shaw's views) be so formed as, in the breeding quarters, to be only "two feet in depth, thickly imbedded with gravel, with a small stream of spring-water flowing into them, in which the larvæ of insects abound."

The small depth is to give the proper temperature to the water, upon which the hatching of the eggs depends. Mr Shaw, by ingeniously leading a small stream of water through a tumbler in his bedroom, in which he had placed some spawn, and raising the temperature about five or six degrees beyond that of the breeding-pond, beat it by nearly a week; and as there are differences of nearly forty days, from the same cause, in breeding in the usual manner, it is probable the hatching might be accelerated generally, were this desirable, without weakening the fish; and in the different depths of the pond, the fry would find the temperature agreeable to themselves. Farther, it is probable that, were the rivers unobstructed, fish might spawn at periods very different from their usual periods at present; and so bring their young into existence in much more favourable circumstances.

Mr Shaw retained the parr in his pond till they became smoults; but this was for the purpose of proving their identity

and transformation. But my understanding is, that these ponds might be left open to the ascending fish, which, after spawning, would vacate them; and the great advantage would be, the preservation of all the spawn, by giving it a proper temperature and perfect peace, with *ish* into the river whenever it might be desirable. As I have said, it appears probable that the fish could return to their native waters, and so reward this peculiar care; or if they did not so return to the precise spot in which they were produced, they would at least in every probability return to the river, and so repay the attention of their breeders more or less.

I may observe, in passing, that a hint may be taken from the observations of these "practical men," as to the construction of ordinary fish-ponds. They not only require to be of a proper depth at the breeding spots, and to have gravel to cover the spawn, but they require also, at these spots, to have *running water*; and if there are various species of fish, to have small streams for each. I have seen instances of failure, after great expense, in which the stillness of the water, improper depth, and, it may be added, improper bottom, were certainly to blame. It is true there are few ponds that have not both regular feeders and voiders; but it is not in the sweep of a stream that fish can breed, nor in spots entirely calm. It is required rather that the stream should merely ripple over them; and that *is* required; but not that it should either flood them or root them up. But many ponds are constructed with scarcely any stream. They are mere receptacles of the water from drains. In these, any fish that are put into them may live; but they seldom breed—unless, indeed, fish that are wholly useless and undersized. The mystery is now explained.

To encourage the breed of salmon, however, every gentleman or other taking the trouble to construct a breeding-pond, and use it, should receive a fair allowance for every healthy parr—telling them off at the wicket on a day fixed.

Nor is this all: the rivers may, I am certain, be exceedingly improved; and for that, too, there should be an equally liberal allowance.

How may a river be improved? I think in many ways; and I will endeavour to mention a few.

First, At present the fish run to the spring-heads, first in quest of the proper depth for their spawn; next, of gravel suitable for covering the deposit; third, of quiet for that gravel; and lastly, of the water abounding with the food necessary to the young.

As nature never does anything in vain, I infer that, if these particulars could be found nearer the mouths of rivers, they would be adopted. This is shown by the fact that, at the occurrence of every suitable tributary, the fish diverge.

Without wishing to hinder the fish, therefore, to seek these natural spawning-grounds, but rather improving them for them if

possible, and facilitating their access to them, might not this be done? At many points in the course of Scottish rivers, there are natural-projecting rocks strong enough to turn away any current, until they are over-peered. Behind these points there is calm and back water, admirably fitted to nourish the young fry, and very often a ripple at the points. The fish are naturally tempted to deposit there, and often do; but on the coming down of the rivers, the breeding-beds are torn up, or crushed by mountains of gravel, and even the quiet feeding-grounds either filled up or swept away.

A small artificial stream might be made to trickle from this rock farther within its protection than at the point, so as to cause the fish to spawn there; or the point might be slightly extended, by putting down a rock in continuation, so placed as to have no chance of being severely borne upon by the current; for, by due precaution, the stream may, like the gale, be made to follow any direction desired. It might well justify the expense, to place over such a guardian of an extensive pool, an iron-railing of such power as should resist any ordinary weight of rolling stone, while it suffered the water to pass; or a properly slanted defence might even turn the water also aside, and thus form pools in the recesses of the rivers.

Or a bed of the proper depth, and of some length, might be formed for a small artificial stream, abutting into such a pool; and thus, by, as it were, a slight tributary, placing the breeding-ground out of all danger from the floods of the river.

Such tail-ponds might even be rudely partitioned off from the river, so as merely to make them calm; or at the bottom be trellised in, while the breeding was going on, against the approach of enemies—at least of larger fish.

Then the wooden boxes for carried spawn, on the French principle, are proved to be no chimeras, for they appear to be in that country breeding fish in them by millions; and Mr Young has not merely confirmed that principle by his practice, but, as I have already shown, has most probably led the way.

These boxes being made large, covered, and securely anchored, with openings at the lower ends, permitting the fry to pass out, they would not require to be opened after being set, until required to be refilled. They would afford no protection to the excluded fry, unless the young creatures should for a time return to them. But tail-ponds might be formed for them on the same principle as for the other beds.

Or, *lastly*, there might be side-ponds, on Mr Shaw's principle, for *carried spawn*, with issue for the fry, to at least some pool convenient in ordinary states of the river, and when only the breeding-ponds need be opened.

Having in this way provided for the increase of the young of fish—protected the rivers from the intrusion of the refuse of manu-

factories—cleared them of the barbarous flapping of the paddle-wheel—cleared them of otters, by paying for their destruction—of the pike and other destroyers, either in the rivers or at their mouths, by the same means—improved the banks and run of the rivers, not by making the banks entirely smooth, nor the run too strong, but rendering shallows less frequent, and entirely removing heavy leaps—and, above all, having so schooled our rustics as that they would consider it beneath them to do anything that the whole world might not see, *and especially disgraceful to destroy a breeding fish*—the next, and not the least important point is, to consider *how to manage the rivers.*

There are two principles for deciding this subject—equity and expense.

The Reviewer, with all his flippancy, has stated the question of expense with perfect clearness, because it could not be considered for a moment without so presenting itself that there could not be two opinions about it. He has shown that, in the not considerable river the Tweed, at least 350 men, with an immense apparatus of stake-nets, bag-nets, cruives, doaches, and all manner of contrivances, legal and illegal, may be said to be employed in the capture of a single salmon. He shows the perils, the almost invincible perils, of the progress of the poor fish from Tweed-mouth to Peebles, &c., and how, after, in spite of every discouragement, having succeeded in pursuing its course, with the object of continuing its species for its most ungrateful persecutors, £10 may be expended on a fish worth 2s. 1d., and still the fish escape. I have given him the credit of having shown this, because it is the only thing he has said that is not cribbed; though, throughout, he speaks as if what he is saying were original, and all the world, except himself, were fools.

He leaves the question of equity quite untouched; but, to save expense, he advises as follows—namely, after "*a radical reform*" in the *principles* of management, "to erect, or work in each river, at such place, or several places, as might be most suitable, some engine which shall, with alternations properly regulated, *take every fish which ascends to it*, or allow all to pass; dividing the produce among the proprietors of the present fisheries in such proportions as shall be *ascertained* to be equitable," but giving no hint as to the mode of ascertaining the equity; no arguments to show that there is any equity in his proposal; and, of course, no hint as to the nature of his engine. He leaves all these to be worked out by "practical men;" and when they have done their best, he will very probably tell them they have done nothing, and know nothing; and order them to their studies in some inconceivable shop, as he has ordered Mr Shaw and his friends to go down with the smoults, and, having studied under water for the season, (most probably with the Poet-Laureate's "merman bold,") return with the salmon, and *then* they

will be entitled to say they have done something towards elucidating the history of the fish.

Every respectable cook's oracle, in giving directions for cooking a hare, begins with "first catch your hare;" but this salmon proprietor's oracle gives directions merely "to erect or work a machine, *which shall take every fish which ascends to it*," holding it *pre-understood* that the fish *will*, in such circumstances, ascend to it; but this is not quite certain.

There is, it appears, among the inventions of the enemy, what is termed "an armour net." "It consists," says Mr Williamson, "of two nets, of which one has meshes of the common size, the other meshes five or six times larger. The former is *superposed* upon the latter, so that when the double net is placed in a vertical position, the small-meshed net shall face the current. This formidable engine being drawn across the lower end of a pool, and a stop-net across the top, several men beat the water with long poles, and punch the rocks and stones, to scare the salmon from their haunts and hiding-places. Thus attacked, many of them make a desperate effort to escape down the stream, and, striking with violence against the small-meshed net, carry a portion of it through the large meshes of the other, and thus get so completely entangled by the gills that their attempts to escape soon become fruitless."

I should say that, in such circumstances, any attempt to escape must be *instantly hopeless*, they being obviously completely bagged in; a very excellent idea, perhaps, for meshing fish to be placed in ponds, where a few only are wanted, but, as will be immediately shown, hopeless for any other purpose.

"It might be supposed," continues Mr W., "that in this way very few would be allowed to get away. But," (mark the reality!) "it is a somewhat singular circumstance that, after a good many have been taken, multitudes continue in the pool, *which no exertions of the fishermen can draw into the net; they will come close up to it*, and may be seen swimming within the bag made by the current, *but, on being approached, they, instead of dashing downwards, move to the centre part of the pool or the upper part of the stream!*" Fish, therefore, are not so stupid as reviewers take them to be. "*Deus anima brutorum*," said the sensible and, it would almost seem, pious Romans; and when bees and ants, so infinitely smaller than fish, can see and communicate upon subjects of either danger or advantage, in a way that surprises all who have become cognisant of it, it follows that some respect must be paid to the intellects of fish. It is quite clear, indeed, that no creatures can be more sensitive to sight or touch; and, from many circumstances, we must conclude that they have other faculties, in sight of which we should stand abashed. If we are not careful not unduly to alarm them, we may soon come altogether to want the fish. *Whales* are decidedly changing their ground, it is held—from being unduly disturbed;

therefore we must have some care of the means adopted to capture salmon.

As to the moral propriety of a change in the management of rivers, it is not less distinct than the necessity for a change upon other grounds.

It is confessed on all hands, that the object of every lower-river proprietor at present is, to intercept as many of the fish as possible, and that by every means. It is needless to go into the details. It is confessed that all the engines used are for the purpose of intercepting as many of the ascending fish as possible, and this if *the breed should be extinguished for ever.* It is equally confessed that all this is intended to leave, and does leave, the least share possible to the upper proprietors; and yet on their properties alone the breeding grounds at present are; in their grounds alone the fish are bred; and without them there could be *no fishing.* The upper or breeding-ground proprietors, therefore, would seem not only to have an equal right in the fishings, *but the best right:* carry the argument a little farther, and they have the only right; and these lower proprietors are like men who, having no preserves of their own, yet intercept all the game which they know is, and must be, *their neighbours'—not theirs;* and, morally speaking, they might as well intercept the sheep and cattle bred on the hills of their neighbours, and *returning from their winter pastures,* as intercept the fish bred in their spawning grounds, and returning from the sea.

There is another argument:—These lower proprietors have not a miserable mill on the banks of the river but they claim water for, and have a right to debar the upper proprietors from intercepting it. It is furnished at great loss to these upper proprietors; for the weirs necessary to draw off the water at the proper height, have an effect little adverted to, but still extensively injurious—that is, these weirs, by sending the water back, and keeping it of an unnatural height, it soaks into the fields along the banks to a corresponding height, and so either destroys their productive powers, or entails the necessity of puddling the banks of the river, or of intercepting the infiltration by drains. Yet this weir or dam-right, if not worth sixpence, is held sacred. Won't the argument reverse? Ought not the upper proprietors to be equally entitled to prohibit the use of any engines by their lower co-proprietors that can prevent them having at least a *fair share of the fish,* as these lower proprietors to prevent any measure affecting their right to the use of *the water?*

There is a third argument. The area of the rivers opposite to the estates of the upper proprietors *is theirs;* and "may not a man do what he will with *his own?*" In these spaces are the breeding grounds of the salmon; but the proprietors of these spaces are not allowed a fair share of the salmon. Why, then, must they suffer them to breed there? There is no servitude upon their lands to

prevent them taking shingle from any part of the bed of the river opposite their estates. They might in this way dig up every particle of spawn and throw it on their fields, to sharpen the soil; or they might collect it into ponds, keep there the fry until transformed to *smoults*, and, in that character, use it as *fresh or pickled smoults;* or try, by means of *salt-water ponds, to turn them into salmon, without suffering them to descend the rivers.* No one could contend against this; no one can doubt that the fishing might not thereby be injured or extinguished; and though it might be barbarous, it would not be *unjust*: whereas the present plans and purposes of the lower proprietors of salmon-rivers may have a touch of both.

True, the proprietors of the lower banks of rivers may say, we purchased our lands with this custom in existence, and paid a corresponding price. If they have any guarantee for the continuance of the custom, they may go upon their guarantees. As for the *claim of right*, the proprietors of a Border estate, whose ancestors purchased, or otherwise came into possession, when cattle were in use to be lifted, might as well claim that cattle should be lifted still; and that he should lift them himself, or have the privilege of claiming or taking what he might, while the cattle were in the act of passing through his lands, as any one attempt to support this argument from custom. It is claiming the right to portion a daughter from the *harvest-take* of fish, as the Border barons used to do from the plunder of the harvest-moon.

Very few have interested themselves upon this subject, though it is of very considerable importance. Why should they? It is only of importance to the *public*, or a few upper-river landlords, neither of whom would ever dream of making the slightest return to any one serving them, however importantly, though both would no doubt take advantage of the service. All who have taken the trouble to think upon the subject, however, have more or less decidedly condemned the present mode of working the rivers. The owner of the *Goose with the Golden Eggs* was not more absurd in his treatment of his goose, than the proprietors of these salmon rivers in the treatment of them; for the lower proprietors fish as if it were, "after this year the deluge;" as if they were utterly careless whether they left a breed or not;—but the goose proprietor had this justification of his conduct, that the goose was his own; whereas these lower-river proprietors are operating upon what is certainly not their own.

To render it possible to improve all the capabilities of rivers as fishing streams, and to use them in the most economical manner, I have, ever since I had the advantage of hearing the very striking report of Mr Shaw's experiments, contemplated what I am now about to urge, although the proceedings of the French fishermen and their government have roused me to urging it at this particu-

lar time. As Mr Williamson has had the merit of coming to the same conclusion, (it must also have been immediately after Mr Shaw's experiments,) and has even anticipated a great part of the details, I will not, like the Reviewer, appropriate them without acknowledgment, but rather endeavour to fortify myself by giving his details at length.

After lamenting the many unwarrantable plans of individuals to fill their own pockets, however temporarily, and in utter disregard of the interests of others and the public, by illegal erections of every description, stake-nets, bag-nets, *doaches*, (which appear to be actual dams across the river, preventing the pass of a single salmon, unless the flood is extreme—yea, even in slop time, for then they contrive that the stream is too strong for the way-worn and loaded fish to breast,) he recommends as follows:—

"1st. The first thing to be done, is to have a minute and accurate survey made of the salmon rivers, in which survey the following points are to be attended to: *First*, the various properties through which the river and its tributaries flow are to be noted, and the length of their courses through each of them; *second*, the principal haunts of the salmon during the period when they ascend the river; and *third*, and principally, the places where they deposit their spawn."

Mr Williamson is thus, as was to be expected of a man of his profession, evidently desiring to lay the foundations for an equitable distribution of the proceeds of the river; and this long before the Reviewer's time, for this appears to have been written in 1840, and published in the Statistical Account of his parish in 1843; the Reviewer's lucubrations in April 1851.

"To ascertain these points," continues Mr W., "and especially the last," (namely, the sites of the spawning beds,) "let individuals be selected, having not only practical experience and local knowledge, but a general acquaintance with the natural history of the salmon, and considerable powers of reflection on the facts that may fall under their observation. In the reports accompanying the charts constructed from these surveys, the writers should not be limited to mere statistical details, but should be invited to state their opinions without reserve; and to suggest such plans as may have occurred to them, in furtherance of the general object for which they have been appointed."

"2d. The second thing to be done, is to cause every obstruction in the channel of the river to be swept away, and no mode of taking salmon allowed, except what requires the application of the hand."

I subscribe to the first clause of this sentence unconditionally, *in its principle*—understanding it to mean all impediments to the natural movements of the fish; reserving the right, however, in case the rivers are anywhere *too rapid* for the easy progress of the

fish in their gravid state, to abate these rapids by any advisable means. It will depend upon *subsequent arrangements*, whether the *second* portion of the recommendation should be adopted.

"3d. The third thing to be done, is to require from every individual having property on the river, or its tributaries, a return of the number of salmon taken by him, or by his leave, in the course of the season,"—or a proper number of seasons.

This suggestion is, again, obviously in the idea of obtaining the means of an equitable distribution of the general proceeds of the river. But without adverting to the diligence of the proprietor, or the contrary, in times past, I would incline to take into account capabilities of improvement (by making spawning-beds, ponds, &c.) for the future.

"4th. The fourth thing to be done, is to provide for the protection of the breeding fish. This can only be done by a numerous, active, faithful, and well-paid police."

Mr Williamson appears to know well the parties he has to deal with; "gangs of nimble and powerful young poachers, conducting their operations, *often in disguise*, under cloud of night, amidst remote and unfrequented glens, on streams flowing underneath high rocks, and through extensive copsewood;" for which, I fear, education to habits of honesty and independence of character will alone be availing. But here is Mr Williamson's plan: "This police should be brought from a distance, and periodically shifted from one station to another, like excise officers. No person in the district should have a word to say either in their nomination or removal." This last, also, would depend upon circumstances; he goes into details which the subsequent suggestions may render unnecessary; but, in case not, they may be given, and they are as follows:—

"Reckoning the average of each salmon to be 6 lb., (?) I should say that a tax of a halfpenny per lb., in ordinary years, would be quite enough to defray the expense of this establishment. Unless these or similar measures of practical energy be adopted to put a stop to river-poaching, we shall never have a steadily progressive increase of salmon, nor ever a permanently abundant supply," and both are exceedingly to be desired.

He goes into the reasons urging to this. "It is truly grievous," he says, "to see large and beautiful fish offered for sale, in a state *totally unfit for use;* and, if habitually used, certain to produce bad effects on health." As to which I should say, why not protect the salmon market as well as the beef and mutton market, and punish all parties concerned in such traffic?—the dealer, the poacher, (or, if he cannot be produced, punish the dealer in his stead,) and even *the purchaser*, if a penny-wise alderman, desirous of showing-off at a saving of 2d. per lb. on his fish; and if a *magistrate*, (*as often happens*,) to jail with him, without reprieve.

"Unlimited reliance," continues Mr W., "cannot be placed on the fecundity of the salmon;" especially if she is not allowed to breed. "Looking at the quantity of roe in a single fish, the fecundity would no doubt be incalculable, did each roe become a salmon;" but it is needless to say that this does not happen. The average is generally supposed to be one in one hundred; but, by the plans above detailed, it is to be inferred that this might be altered.

It is to be inferred, also, that alterations might be effected in the other causes of decrease—from steam-boats, saw-mills, (for it seems sawdust is very pernicious,) dye-works, &c. &c.; and also from armour-nets, shoulder-nets, drag-nets, and all other unjustifiable modes of fishing. In the mean time, these are some of the things that now exist, and some of the suggestions towards a better policy.

Government is the instrument to which Mr Williamson would resort; but so would not I; for, in this case, it is unnecessary, and would be injurious, as a general thing. It is the duty of Government to reward public merit, which no one else will reward; it is the duty of Government to encourage schemes of public beneficence, by encouraging and rewarding their promoters; it is the duty of Government to give good laws, and to see them executed; but it is not its duty also to execute them.

I am clearly of opinion that the salmon rivers should be surveyed, not only with a view to ascertaining their present state, but also with a view to improving them, as I have mentioned, as breeding streams.

That all improper obstructions to the ascension of the fish should be removed; and, if possible, new facilities be introduced.

That the capabilities of different portions of the rivers should be ascertained, with the view to rendering them available.

That everything should be done for the protection of the breeding fish; to encourage the resort of the fish; to increase their numbers, and improve their weight and quality. If, as is said, there are superior breeds of fish, as well as of cattle, &c., and that independent of the capabilities of the rivers, or the soils through which they run, then it must follow that these superior breeds should be naturalised, if possible, in all the streams; and the *spawning-box* gives the opportunity of making the attempt.

The best modes of fishing the rivers also, and these only, should be practised; every facility being given for the ascent of the finest fish, and no fish in an immature or unhealthy state being taken; under which head I would forbid the taking even of the finest grilse, if it could be avoided; and nothing being done to discourage the fish from entering the streams, or not to encourage them by every means, even to creating the power of artificial floods, and using them whenever the interests of the fishings should require it.

All these things should be done, if the country would show

itself, like other countries, alive to the interest and comfort of its people, and to turning the public patrimony to the best account. Many years will not pass till the conduct that has so long been tolerated in Ireland, in particular, in relation to the land, will be pronounced disgraceful to the country and the Government; and, though the use of our internal waters is doubtless of far less consequence, it is yet no trivial matter; and at present they are as completely mismanaged as ever the land in Ireland has been. The proper quantity of fish is not generated; the fish generated are mismanaged, by being killed at improper stages, and in an improper state; the management is equally expensive and inefficient; and from all together, the public is deprived of a nourishing and grateful food, except at an extravagant price; and often, in quest of that ridiculous price, the fish is insolently carried away, (as was the corn from Ireland,) as if the country that produced it had no claim.

I am quite clear that, in the contemplation of all these changes, the rivers should be surveyed, as Mr Williamson suggests, "by persons having not only practical experience and local knowledge, but a general acquaintance with the natural history of the salmon, and considerable powers of reflection." And, for all these purposes, who so fit as Mr Shaw?—who else, indeed, to be endured, after what he has done? He might have persons of engineering ability joined with him, but at the head of the inquiry he should be; and they should report upon all such points as have been touched upon in this paper, and perhaps many more.

But though these surveys should be made, and many of these things done, and imperatively done, they should not be done by the Government, but commanded by it. The Government, taking the public interest into view, and also the interests of individual landlords, should form the persons holding property on the banks of the different salmon streams into corporate bodies, for the purpose of improving, protecting, and working the streams. If, in every petty town, the landlords of property in common can be compelled, and must be compelled, to unite in maintaining the roofs of their houses, in keeping up the pavement in front of them, in removing nuisances, and even placing lights and bell-pulls in common stairs, surely it must be proper to compel the persons holding valuable fishing-streams in common, not only to do justice to one another, but to unite in managing the property in common in the most just and perfect manner, for their own and the public interest. No one can deny that the breeding-grounds of rivers are the very first ingredients in their value, while at present the proprietors of these grounds have hardly any interest whatever in the fishings to which these grounds give rise. No one can deny that the improvement of these grounds would be of the most vital consequence, while no one in his senses could be expected to

improve them under existing arrangements; for it would be to improve, at his own expense, for the almost exclusive interest of others. It must be equally clear, that *the run* of the rivers throughout is equally indispensable; and consequently that *the whole proprietors* should have an interest in the fishings, because the grounds of all are essential to them. And how can these interests be adjusted—how can the fishings be cheaply and rationally managed, but by a joint management, and by giving all the proprietors *pro rata* interests in the fishings and their proceeds, according to *the length of their properties along the banks of the streams*, including tributaries?—converting their contents according to the average breadth of the river, and considering at all times *length and breadth together*, except in the case of breeding-grounds, which should have a separate and peculiar value?

Nature has no more said that the lower proprietors of rivers should seize all the fish passing through their lands, though undoubtedly bred in the lands of others, than that these others should continue to suffer fish to be bred in their lands for the exclusive interest of their neighbours. The common sense, therefore, and the justice of the case, require, that where the interests of all are inextricably bound up together as regards the production of the fish, all should be considered in the distribution of the proceeds, in proportion to the relative value of their services.

These principles being established, the management in other respects would be easy. The rivers would be common properties, though in different proportions, and therefore managed for the general behoof. All the reasonable expenses of improving and protecting the breeding-grounds, or the run of the rivers generally; of protecting the fish in all stages; of capturing the fish upon proper principles; and of realising the proceeds;—all these must be charges against the general fund, and deducted before division; and that division would naturally take place upon principles settled at the amalgamation. This, I think, would give every scope, and every incentive to improvement in every direction. Every proprietor along the banks of the rivers would have a rational and equitable interest in suggesting every species of improvement, and in seeing the general management properly conducted; in protecting the waters in his neighbourhood; in suggesting the most inexpensive and judicious principles of fishing; and, finally, in fixing the dividends to be paid on his river shares, or Fish-stock, as if they were Railway, Bank, or any other species of stock.

Rod-fishing should, doubtless, be encouraged, particularly for amusement; but fixing the particular months or days, and even the hours in the day—the rents, of course, to go into the common fund; and proprietors might fish, or give liberty to their friends to fish, by retaining and paying for so many rods. To show without trouble who were licensed, each fisher might wear a

badge; the badge to obviate frauds, showing the license for the year, (which might be in very small space,) under a glass, and the badges not to be transferable.

These are some of the principles, at least, on which this very important matter might be adjusted, and I think ought to be adjusted. It would put an end to all separate and expensive plans of fishing, and to all the barbarous plans of obstruction and destruction resorted to by the lower proprietors or their tacksmen; and so leave the rivers free to the fish, in their natural state, unless when, at the most proper season of the year or day, fishing should be resolved upon. At present, the plans of fishing which the law is compelled to lay down are so expensive, and, after all, so uncertain in their ultimate results, that, after the capture of fish to the value of many thousand pounds a-year, there is still often much loss; and this, after plans have been adopted, in the last degree harassing to the fish, and all but dishonest, if not absolutely dishonest in themselves.

An ingenious friend has mentioned, that even the fishing at the mouths of rivers by the sweep-net is injurious, as destroying all the small *crustaceæ* there, on which the salmon are accustomed to feed; and no doubt this is the fact, besides intimidating the fish from entering, on the very threshold of the river.

What, then, would be the best and least expensive plan for fishing rivers, supposing all things so ordered as that it would be unnecessary to adopt any but the most efficient and least expensive plans? This is the last question.

No doubt this must vary in different rivers, and in the different circumstances of the rivers. Local experience, therefore, and *experience proceeding on the altered state of things*, must decide this also very important particular.

From the intelligence exhibited by fish, as above narrated, it would seem that the plan to be adopted should, from all considerations, be at once gentle and decisive; causing no disturbance, spreading no alarm, and even allowing, if possible, unripe fish, or fish in a state forbidding their detention, to be returned uninjured to the stream.

For this purpose, it is quite clear that the rivers would require to be, at certain places, prepared for this operation.

At a convenient place near the mouth of a manageable river, the following might be the operation:—A very powerful net, of great size, might be laid flat in the stream, fixed to the bank on one side. At the proper time, by machinery operating on the opposite side and ends, the head of the net might be *raised up, so as to form a stop-net*, and almost simultaneously the unsecured side, so as to prevent the fish siding off; and lastly, the lower end should be raised. On the secured side, there might be a bag connecting with a sluice, or with a siding in the river, admitting

of being enclosed; and the machinery raising the net on the opposite side, and causing it gradually to run together towards the sluice or siding, it would, without noise or tumult, *deliver the fish;*—after which, the net could be returned to its position.

In this way the bottom of the river, as it were, would periodically rise up, to deliver the fish that might at the time be over it. They would be unalarmed—they would be uninjured; and, through openings of the proper size in the siding or at the sluice, the small fish could be permitted to return to the stream.

The head of the net, as it rose, would form a doach of net; the body of the net, in returning to its position, would act as a sweep-net; and when fairly at its position, and again raised and seconded by the end rope, would form a new enclosure, for delivering a new capture of fish.

It is not supposed that the fish could be alarmed by this. Here would be no beating of the water—no exhibition of captured fish. As the net gradually contracted by running on its man-ropes to the sluiced side, the included fish would merely be seen swimming to that side. They would be in no perturbation, nor struggling by the gills. They would be gently worn into the bag-net or the siding, and, without tumult, led and removed from there. In short, this would be a great net, permanently fixed; or, when in operation, fixed to one side of the river, and its man-ropes only raised up by machinery, because of their weight and strength. In the *sidings* here mentioned, the fish might even be kept alive, but at all times under command; and wearing as many as it were desired to secure, into a still inner enclosure, the water might be let off from them, and death effected without any violence. But it will be obvious that I descend into these details, not so much in the idea that they can be practically useful, as to indicate what I think should be held in view, in any plans that may be considered. At every convenient place the plan ultimately deemed proper could be repeated, and thus the river completely cleared, so far as might be expedient.

In rivers abounding in pools—and, as they may be termed, tide-pools, from only assuming the character of pools, by the receding of the tide—doubtless the net and cobble would still be used.

Nothing would now be improper or ineligible, but from its expense or inefficiency, or from disturbing the fish; for now there would be no conflicting interests to require slaps, or to impede any plan from the exterminating character of its operations. The proper number of fish would be permitted to go to the spawning-beds; the localities for those beds would be improved as far as possible, to adapt them for their purposes, and protect them against the floodings of the river; and they would be protected, both before and after the extrusion of the fry, against either fowls of the air or voracious fish. In short, the property of the river would be as

one—the interest as one; and the best would be done to stock it to the utmost it could maintain; to increase its capacity of maintenance, by collecting its head-waters and improving its channel; and, lastly, to fish it so far as advantageous, and at the least possible expense.

These, at least, are the objects to be sought; and by the concurrence of proprietors on just and proper principles, there is no doubt that these objects could be attained. There can be no doubt that, were these objects attained, the gain to Individuals and the Country would be very great; and having taught other countries to thrive in this particular, as the discoveries of Mr Shaw have most certainly done, it will be hard if, from any cause, our own country shall continue unbenefited.

Mr Shaw's paper will be found in the *Transactions of the Royal Society*, vol. xiv., part 2d., 1840; Mr Williamson's in *The Statistical Account of Tongland*, or, as reprinted with additions, in a pamphlet entitled "*Thoughts on the Present Scarcity of Salmon*, by the Rev. D. S. Williamson, minister of Tongland, 1852." Mr Young's experiments are referred to in *Blackwood's Magazine*, July 1843; and the *Edinburgh Reviewer's* article was published April 1851.

THE FARMERS' NOTE-BOOK.—NO. XXXIX.

Characteristics of the year 1852. By Mr TOWERS.—If the reader turn back to the article, under this title, commencing p. 306, March, Number 36, it will be seen that "particular attention to the meteoric phenomena which precede, accompany, and immediately follow the period of the two equinoxes," was there solicited. The peculiar seasons of the present year (1852) re-urge such attention, in so much as they have tended to weaken the faith upon many points which may have been viewed as prognostics. This it will be my object to prove, by registering the meteorology of each month in its general course.

January.—By referring to the *Characteristics* of 1851, p. 314, it will appear that "the frost ceased on the 4th December, the thermometer marking 31° Fahr. It had been expected that a hard winter would be established; but in fact—however it might have checked the crop by its early severity—winter, so far as to season, had then virtually passed away in the south of England; for, although the mercury fell to 31° on the 1st morning of the new year, to 28° on the 2d and the 5th of the month, yet there was not a single day of the entire month that proved frosty throughout. Dividing the month into two periods—from the 1st to the 16th inclusive, and thence to the end—the barometric average during the former I found to be about 29 inches 62 cents, (the

greatest depression on the 11th morning, 28.97 cts.;) that of the latter almost exactly 29 in. 80 cts.—being on the whole about $\frac{21}{100}$ cts. below the estimated average of January. By my instruments, the average temperature of the whole month—night and day—was 42°.3, being 6°.2 cts. *above* the estimate. In respect to the direction of the wind, my tables note 24 days at some point between south and west, variable in force, very strong on the 8th, 15th, and 31st—three days from N.W., two from the S.—strong on the 21st—two days from S. to E. The atmosphere was clear and sunny, chiefly in the first week, and also on eight other days of the month. Several days were gloomy and overcast with clouds, and rain fell on sixteen of the days or nights—profusely on the 13th, 15th, 21st, 24th, and in considerable quantity on the two last days. A furious storm in the night of the 24th. Upon the whole, the month was a fine one, bland and genial—the wheat crop advancing a little, but always healthy: the land was in capital condition, but much work remained to be done. The chief celestial phenomena were a lovely conjunction of Venus and the Moon on the 23d, two nights after the change; and a double highly-coloured halo (*parselene*) on the 29th.

February.—Viewing this month throughout, its character must be considered anomalous, though exceedingly fine. The instrumental observations give the following averages:—Barometer, by two daily readings, 29 in. 97 cts.—a trifle below the general estimate, *i. e.*, 30.067. Thermometer—lowest or night temperature, 34°.8; maximum by the days, 45°.5; mean average of the two 39°.65′, *i. e.*, more than 1½° above the estimated mean of 38°. On ten mornings the night thermometer had marked a few degrees of frost—the greatest depression, to 24° or 8° of frost, on the twenty-first morning. On the first, my instruments marked 49° minimum, 56° day maximum, 47° at ten in the evening; as a contrast, on the 29th, 32° minimum, 41° day maximum, and 32° at ten P.M. were read off. The prevailing winds, during eleven of the days, were south-westerly—all between the 1st and 19th, at intervals, varying to north-westerly on four days, and to some eastern point three days. After the 18th, the direction was north-westerly on six days, the force rarely amounting to a gentle breeze, intercepted by a keen brisk current from N.E. and E. by N. from the 22d to 26th, both inclusive. As to the weather, a very little rain fell on the 2d, 4th, 5th, 6th, 8th, 16th, and 28th. A few particles of snow were seen on the 10th, and a film of ice at night, on the 11th. The ground was never covered by snow at any time. All the other days were dry, and many of them sunny. Thus February completely repudiated its moist and watery character: the ground being always in fine condition, field operations went on favourably, and the time previously lost was amply redeemed.

March, considered as the most important month of the spring in ordinary cases, demands particular attention *now*, not only as it presented a complete contrast with the corresponding month of 1851, but by the extreme regularity and coldness of the weather, so completely at variance with its received characteristic. The barometer, during the three first days, advanced from 29.70 in. gradually, till in the evening of the 3d it marked 30 in. 20 cts., averaging very nearly 30 in. It then rose very rapidly to 30 in. 73 cts. on the 6th—fluctuated a few cents—being always above 30 in., till at 10 P.M. of the 23d the mercury stood at 30 in. The average of the above twenty days was 30 in. 35 cts. Then declining to 29.26 in., it again rose (with change of wind) to 29.83 in. on the 31st night. Thus three irregular periods are marked out.

In the first of these, (1st—3d,) the temperature by night averaged 29° Fahr., the wind changing from S.W. to N.E., at which, or some eastern point, it remained during the period of high barometric pressure above alluded to. On the 22d day, fluctuations in the wind and temperature were observed; and these continued till the 31st, when the current from a point east of north was again established. The *averages* of temperature (Croydon) throughout the month were—*lowest* by night thermometer, 32°.35—maximum by day, 48°—mean of the two, 40°.18. The greatest degree of cold I found to be 20°, (12° of frost,) on the 5th. Thirteen frosty nights were registered, but not one day frosty throughout. The wind was easterly, or by north twenty of the days, by south seven days, and west or by south on the 1st, 22d, 27th and 30th,—with slight deviations of a few hours.

The spring *equinox* occurred on the 20th, at forty-two minutes after 10 in the morning—the day brilliant — wind S.E., gentle, barometer 30 in. 10 cts., tending to rise, which it did in the night, but merely $\frac{1}{100}$th of an inch. *This equinox yielded no traceable prognostic.*

The low temperature of the whole month, and the extreme aridity of the period, tended to retard the growth of all the crops, in which, notwithstanding the power of the sun, very little activity could be discovered.

"*March winds*"—"*April showers.*"—We need not complete the couplet. In the former not a single gale is upon record: it remains then to exhibit the *Characteristics* of the latter month. The pressure of the atmosphere throughout its course was so great that the mercury of the barometer stood at some cents above 30 in.; for, although for seven days after the 21st it receded to a trifle below 30 in., and on the 30th night to 29.55 in., yet, upon the whole, the excess during twenty-two days more than balanced the averages. Aridity prevailed, and with it a very low temperature. Thus the thermometers indicated the average of all the nights to be 35°.23.

During the day the solar power was so great as to raise the mean average to 54° and a fraction, the two giving a mean temperature of 44°.66, being *five degrees below* the standard.

The prevailing winds.—North-east and east, or by south, in twenty-five days. The current lively till the 10th, thence gentle or fluctuating: strong on the 23d and 24th days. *South-westerly* on the 20th day and in the three last days, and north-west on the 27th only. The atmosphere was overcast on the 18th, when *there was a shower.*

The weather changed with the wind on the 27th, after which there were cirrus clouds, cumulus, and stratus masses, producing seasonable rain and a more genial temperature—maximum, 64° and 65°.

The crops advanced very slowly, wheat remaining low, and in some places scarcely discernible. Spring sowing proceeded. Winter barley and beans appeared the most promising. The oak began to take the lead before the ash-tree.

May was a fine month upon the whole, retaining still the dry character of the spring. The barometer gave a considerably reduced average. By my tables, of two diurnal observations, I find that to be very nearly 29 in. 945 cts., corresponding with the estimated mean—viz., 29 in. 898 cts. The mercury rose from 29°.80 on the 1st, to 30°.28 on the 6th, then declined, and was rarely so high as 30° all the remainder of the month.

The thermometer was low till the 7th, the nights of the 3d, 4th, and 5th marking five, four, and two degrees of frost—that did injury to the currants and gooseberries: the former, I perceived, had lost, for many of the full-formed berries had fallen off the racemes. During this first week the wind continued in the north, or north-east; it then varied, and blew rather freshly from south-east to south-west, till the 16th, bringing ameliorated temperature, and some refreshing rains, at intervals, between the 10th to the 14th, inclusive. On the 17th the wind (if any) fluctuated by every point; the atmosphere was electrical; the night thundery, with rain. Easterly currents were re-established till the last day, when that change commenced which will be noticed in June. The averages of temperature were—lowest 43½°—highest 59°.1—*mean* of the month 51°.3, which is below the estimate given by the *British Almanac*—(54°) by 2° 7 cts. Twenty of the days were dry. On ten of these the sun shone brightly. Rain, more or less, fell on eleven occasions—frequently by night—the 26th was thoroughly windy, cold, and wet morning and night; and more rain fell on the 27th and 28th. Vegetation became active after the 14th, but there was little promise of grass, and the wheat plant remained backward, and in some places scanty.

June proved altogether ungenial in its weather, though in some

respects benefit was derived from its change of character. The barometer was rather low throughout; the average by my instrument being almost precisely 29 in. 7 cts. The first day marked 29.85 in.; it fluctuated, till, on the 14th, the index was set at 29.28 in. (the lowest); whence it rose by degrees. In the night of the 24th, the mercury was 30.06 in., thence declined to 29 in. generally; the month closed with it at 29.92 in.

The temperature was low—the lowest degree being 41° on the 1st morning; the highest, 74°, on the 25th, about three in the afternoon.

The nightly average, by my instruments, was 44½° minimum; that of all the days, 64°; giving a mean of 54° and a fraction; being 4.7 *below* the estimate (58.7.) The wind throughout came from some point between south and west, excepting a very few variations to W., W. by N., and S.E.; the *last* occurring on the 5th and 25th nights.

Rain fell every day (excepting the 12th, 21st, 23d, and 25th) and frequently in quantity. The sky was generally overcast with clouds. The sun was seldom seen; the finest days were the 24th, 25th, and the 30th, on which last day a decided change commenced with a forcible west wind.

The grass-crops had been much assisted by the soaking rains of the month; the corn-plants also improved rapidly under the more genial temperature, which commenced on the 14th. Wheat and barley were generally in ear on the 23d—in some instances, more early; and hay-making went on freely after Midsummer-day. Till the close of the month, all the crops, by consentient evidence, were pronounced to be most promising—peculiarly so!

July, which is considered the showery month of the summer, afforded another instance of the periodicity of this extraordinary year. The barometer began to rise with the violent west-wind of June 30th. On the 1st morning, the mercury stood at 29.99 in., and rose to 30.10 in. by ten o'clock in the evening. On 18 of the days, it marked 30 in. to 30.16 in.—its highest degree. On the other 13 days, it receded below 30 in.; the lowest being 29.70 in. on the 25th and 26th. The average mean of two daily readings I found 29.99 in. and a decimal.

The temperature of the month claims especial notice. The maximum of the first day was 70°; it rapidly advanced to 79° on the 4th, and 85° in the shade, on the 5th. Other tables have given a far higher reading off; and *this*, with a blazing sun, (sometimes at 120°) during thirteen consecutive days! The nights were seldom oppressive, the average of all being 59°. The day maximum was 75°.6 mean temperature; the month 67°.3, being about 6° above the estimates. The winds were easterly, running 18 days, the major part near to the 17th. On the 16th, with cross electrical

currents, we had *here* one of the grandest displays of lightning that I ever witnessed. The thunder was distant, and the rain small in quantity; but on the south coast, and at sea, the storm vented its fury, with frightful desolating hail, or rather, masses of ice. Westerly breezes commenced with the 17th, and varied between some southern or northern pointon 13 days of the latter half of the month. We had a very heavy thunderstorm on Sunday evening, the 25th, with much rain, and again on the 26th. All the *days* were fine, and almost cloudless, if we except the 17th, 21st, 25th, and part of the 26th and 31st; but the early mornings were cloudy from the 20th to the end.

Effect on the Crops.—The wheat was in full flower by midsummer, but the grains suffered to some extent from the sudden access of a scorching sun. Hence, the fine milky pulp was dried up, and, as I myself saw, the southern side of several ears was actually browned by the parching rays. Reports of blight, mildew, &c., became rife; but the real cause of injury, whatever its extent, may safely be traced to the excess of solar power upon a plant, rich in moisture, and which had advanced with singular rapidity during the almost daily rains of June. Reaping of barley, oats, and some wheat, commenced at the end of July; but its progress must be considered as belonging to the succeeding month.

August, another, and most critical month, sustaining and verifying the *periodical* character of this eventful year.

The barometer, on the 1st, indicated 30 in. 08 cts., at the earliest morning inspection, but the mercury receded to 30 in. by ten o'clock at night; thence fell to 29.33 in. on the 3d, and to 29.14 in. on the 11th day, (its greatest depression); but it was always below 30 in. till the evening of the 20th, when a marked and decisive change took place. The average pressure of the above nineteen days was 29.82 in. Subsequently, and to the end of the month, the mean pressure appeared to be 30.09 in.; the highest mark being 30.24 in., on the 22d and 23d days.

The estimated mean, according to the table of *British Almanac*, was 29.891.

The thermometric averages, on the same authority, are, lowest 44°; highest 82°; mean of all the days and nights, 61°.6. Now, my instruments marked as the greatest degree of cold, 51°.0; on the 16th morning, the mean of all the nights, $56\frac{1}{2}$°; the mean of all the days, $69\frac{4}{10}$°; the average of both being $62\frac{3}{4}$°, which corresponded with that of the general estimate, within a mere fraction.

The direction of the winds may thus be estimated: Southwesterly, on 20 days consistently, S.W. from the 2d to the 7th day; very strong on the 6th. North-westerly, four days, 1st, 2d, 15th, and 19th. South-east on 4th. North, or north-easterly,

on three days, both interspersed. Furious on the 11th, from S.E. and S.W. Rain fell in great profusion till the 21st, when a decisive and most favourable change took place, and the month closed propitiously for the later harvest. There are registered 15 days without rain throughout the month; but those which occurred prior to the 21st did not much assist the in-gathering, as, after the 2d day, (when the fine weather departed) the wheat, in shock, became soaked, and could not recover a condition for being carried to the barn or rick.*

Since the year 1848, a season so utterly inauspicious to field labour, at a most critical period, has not come under my observation. Wheat, which promised to be pre-eminently fine and abundant, suffered, beyond doubt, both in weight and quality; and, so far as weather was concerned, it could not be otherwise; for, the spring having been arid and cold till the end of May, the volume of rain, with increased temperature, which fell throughout June, produced a sudden and over-luxuriant development of the culms, forming a heavy flag. July, with its fervid sun, caused a sudden check, and, instead of assisting the progressive maturation of the ears, prematurely withered, and dried up the milky pulp. One retarding shower fell on the 24th, otherwise the harvest would have been completed during the last ten days of August.

September came in auspiciously, for the conclusion of harvest began under most critical circumstances, in all the southern counties. The weather remained fine till the 6th day. The barometer was about 12 cents above 30 inches, till the afternoon of the 5th. The mercury then receded, till it marked 29.62 in. on the 21st; then rose, and attained its highest mark, 30.44 in., on the 24th. It stood at 29.40 in. on the last morning of the month. The average mean by my table is 29.87 in.; a trifle below the estimated mean, 29.931 in. The thermometers with me gave for the *three* daily averages of the month—night maximum, 50°.3; day maximum, 63°.79; mean of the two, $57\frac{8}{10}°$ of a degree below the estimated mean. The greatest degree of cold occurred on the 22d, (37°); that of heat 71° on the 2d, 3d, and 5th days. The winds varied frequently and irregularly: they were easterly, and by south or north, on thirteen occasions; southerly, or west, on eight; and by north, on nine or ten; their force gentle, all but calm, but often gusty, and pretty strong, till the evenings of the 29th and 30th. There were five dry days in the first week; seven between the 9th and 17th; six between the 21st and 27th.

* Several thunderstorms of unusual violence (about Croydon) occurred—one on the 17th night was severe, with a very great fall of rain. About 11 P.M. the electric bolt, resembling a ball of blue fire, with sparkling corruscations, fell very near the Brighton line, Croydon East. The report followed instantly, resembling a portentous crash, succeeded by a protracted roll.

Much rain fell during the intervals. Thunder was heard on the 7th, 8th, and 27th. Two rainbows were seen—one most superb in the east—in the afternoon of the 20th.

The *Autumnal Equinox.* September 22d, 9h. 41m. evening. *Weather fine* and balmy; a beautiful sunset, succeeded by a calm and genial day; stripes of coloured cirro-stratus at sunset. Wind W. by N. on the 22d, changing to W. by S. May we venture to anticipate a winter with corresponding meteorology?

As a final remark—the roses, medicinal herbs and shrubs, lavender—the chief of them suffered so much by the cold and drought of May, the over-rapid vegetation of June, and, finally, by the scorching of July, that the results have been deterioration of quality, and a loss of fully two-thirds in quantity. These are great drawbacks, which the extensive districts about Mitcham, Merton, Carshalton, &c., feel severely.

October can be divided into three periods, as indicated by the two instruments—namely, two of ten, and the third, of eleven days. The barometer (1st to 10th day inclusive) gave 29.75 in. for its average; the lowest, 28.96 in. on the 5th A.M.; highest, 30 in. at ten P.M. of the 10th. Second period—30.27 in.; average highest, 30.44 in. on the 19th; lowest, 30.20 in. on the 20th night. Third period average, 29.65 in.; lowest, 28.81 in. early in the morning of the 27th. The mean averages of the thermometer were—lowest of all the nights, 40°.64; day maximum, 53°.3; mean of the two readings, 46°.97—that is, two degrees below the estimate of this month. The lowest degree, 31°, on the 9th; the highest, 61°, on the 22d.

The wind was westerly, from the 1st to the 11th; again, for ten days, chiefly between the 20th and 31st east by north, or south, in the third week. The weather continued to be periodical. After the great fall of rain in the first week, it became charming, bright, and sunny, till the 21st, when clouds, gloom, and deluges of rain, were introduced by the return of the south-westerly wind. This became forcible, and even stormy, on the 26th. It had been very high on the 6th. The green-fodder crops prospered much—mangold particularly; grass was verdant, as in a showery warm April. The quantity of food made the flock-masters indifferent as to *selling*, and, therefore, purchasers were obliged to pay a high price for store sheep and well-fed lambs.

November. The meteorology of this extraordinary month claims particular attention. The barometer was, on the whole, greatly depressed, excepting on the four days included between the 7th night and the 10th day, when its average may be expressed by 30 in. 6 cts. The mean of the 9th and 26th days I estimate at 29.535 in. The temperature of the month was high—the maximum of the 30 days being 51°.5—the minimum, 43°.21, which give an

average mean of 47°.35; and, therefore, above the estimated mean —*that* being 42°.9. The winds were variable as respecting direction and force: thus, my tables give 14 days from west to south; 2 east; 4 east by south; 3 northerly, or by west; 3 north by east; 3 from the south. A calm, or fluctuating current, on two or three occasions, threw doubt upon the observations; and, in fact, the upper and lower currents were more or less opposite, and at varying angles. Eleven of the days were without rain, though generally sunless; but nineteen were more or less rainy, and that to an excess which has produced remarkable and distressing results. Here it becomes necessary to notice, somewhat particularly, several of the more prominent *phenomena* of the month.—*Nov.* 2. Wet and windy from the south, after a red *west* suffusion; at 5 P.M. the evening became clear. — 3. Morning sunny; clouds and showers, and *vast ochrous-tinted masses* of clouds at sunset.—4 and 5. Two of the few sunny days — summer-like. — 7. Storm all the preceding night—wet noon—fierce wind.—9. Overcast; *wonderful crimson-tinted masses* in the west and south-west about 5 P.M.; *earthquake* reported—not felt here, or perhaps anywhere to the east or south of Birmingham.—11 and 12. Much rain—stormy on the latter day.—14. Profuse night rain; floods on the river-valleys; the ground saturated everywhere.—15 to 22. Very wet, excepting the 18th, the day of the moon's first quarter; *martins* playing about in numbers on Sunday forenoon (the 21st.) The weather improved in some degree toward the close; yet the nights of the 23d and 26th were stormy, with copious rain; and, on the 28th, there were several drenching showers. Under these circumstances, floods sustained and renewed to a frightful extent were reported, and without exaggeration. It remains to be stated that the only two mornings on which a slight hoar-frost was seen on the herbage (23d and 25th,) were followed by rain in the evening, and a great rise of temperature.

Agricultural operations have been suspended. Some wheat was up, and, in the drained high-ground, healthy and green. A correspondent in Berkshire writes that "scarcely one-third is sown, and that the land is so wet that the breadth of wheat must be ultimately short." The prospect is certainly discouraging; but a rather frosty January, provided the floods shall have entirely passed away, will go far towards promoting a very great amelioration.

December. On arriving at the 12th month of this eventful year—so directly opposed, in every meteoric phenomenon, of its sweet and benign predecessor—I feel induced to copy, line by line, the weather-table of each day, interspersed with a short notice of any notable concomitant. The reader may be thus enabled to arrive at more precise ideas of what has been the state of the weather in *this* highly-favoured southern county.

METEOROLOGY OF DECEMBER—CROYDON.

	Barometer		Thermometer			Winds		Atmosphere			Weather		Moon
Day	6 A.M.	10 P.M.	Min.	Max.	10 P.M.	Direction	Force	8 A.M.	2 P.M.	10 P.M.	Dry	Wet	Age
	in. cts.	in. cts.											
1	29.92	29.88	29°	47°	44°	S.W.	gentle	fine	cloudy	cloudy	..	..	20
2	29.84	29.94	41	47	42	S.W*ly.*	id.	cloudy	sun	id.	..	..	21
3	30.04	30.04	37	44	42	S.W.	calm	fine	id.	id.	..	..	22
4	29.91	29.92	44	54	51	S.S.W.	strong	cloudy	cloudy	id.	..	night	23
5	29.95	29.95	50	55	52	S.W.	lively	id.	id.	id.	..	shower	24
6	29.80	29.80	47	52	44	W. by S.	id.	id.	id.	id.	..	..	25
7	29.72	29.55	44	48	44	S*ly.* by W.	gentle	id.	id.	id.	..	..	26
8	29.35	29.30	42	49	44	id.	rising	id.	id.	fine	..	..	27
9	29.50	29.60	38	50	49	W. by S.	gentle	fine	fine	id.	..	..	28
10	29.61	29.61	48	54	50	S.W*ly.*	id.	cloudy	cloudy	cloudy	..	..	29
11	29.64	29.66	49	53	47	id.	lively	id.	sun	fine	..	..	new
12	29.59	29.50	47	53	50	South	id.	id.	cloudy	cloudy	..	..	1
13	29.58	29.45	46	53	50	id.	id.	id.	fine	fine	..	..	2
14	29.45	29.37	47	53	45	S.W.	id.	id.	id.	id.	..	..	3
15	29.10	29.16	45	51	44	id.	id.	id.	cloudy	id.	..	..	4
16	29.33	29.20	40	49	49	id.	rising	fine	id.	cloudy	..	..	5
17	29.15	29.20	44	48	48	id.	lively	cloudy	id.	id.	..	..	6
18	30.01	30.30	34	42	40	N. by W.	gentle	fine	sun	id.	..	..	1 qr.
19	30.19	30.05	40	52	45	S. by W.	lively	cloudy	cloudy	id.	..	..	8
20	29.58	30.00	44	53	46	S.W*ly.*	brisk	id.	fine	fine	..	..	9
21	30.05	29.98	42	48	38	W. by N.	gentle	fine	sun	id.	..	..	10
22	29.83	29.78	38	48	44	S.W.W.	id.	cloudy	cloudy	cloudy	..	..	11
23	29.78	29.78	36	40	38	E*ly.* by S.	lively	id.	id.	id.	..	..	12
24	29.77	29.78	38	52	50	S.W*ly.*	brisk	fine	id.	id.	..	..	13
25	29.68	29.76	48	50	45	W.S.W.	id.	cloudy	sun	id.	..	..	14
26	29.76	29.48	42	50	48	South	rising	id.	id.	id.	..	..	f. 15
27	29.06	29.48	48	48	45	W.S.W.	storm	id.	id.	id.	..	..	16
28	29.51	29.80	38	45	39	id.	gentle	fine	id.	fine	..	..	17
29	29.80	29.63	33	48	48	South	strong	id.	cloudy	cloudy	..	..	18
30	29.81	30.05	46	52	44	S.W.	lively	cloudy	sun	fine	..	..	19
31	30.13	30.14	39	51	45	id.	id.	fine	id.	id.	..	..	20

The averages, by the thermometers, appear to be (here)—highest mean, 49°.65 cts.—lowest, by the night instrument, 41°.9—mean of the two, 45°.78; that is—very nearly 7° *above* the estimated mean (" 39°.3.") Though the weather tends to improvement, yet we still can enumerate only 10 days' absence of rain: drizzle, showers, drenching days and night are to be traced on twenty occasions. Our reports of rain fallen during this startling year, by Chiswick gauges, are 30 inches 67 cents to the end of *November*, of which 6.20 inches are referred to *that month;* 2½ other inches are to be added for December—say to the 16th; fully an inch more may be allowed for the remaining 15 days. The most striking phenomena of the last month are—the great fluctuation of the barometer; the tropical entrance of the sun into the winter solstice at 3.31 min. of the 21st day; frightful hurricane of the 26th night; *solar halo* (parhelion) about 2 o'clock of the 28th; and at Croydon, the springing up of the *river Bourn*, near Godstone, and now flowing to the south end of this town. This event has not occurred for eight or nine years. The new year, 1853, opens inauspiciously, by mercury falling, an overcast sky, and moist atmosphere.

A Resumé of the Farming of the Ancient Romans—Their Reaping-Machine.—In a recent number of this Journal, when reviewing

Mr Stephens' *Book of the Farm*, we had occasion to notice some, at least, of the more striking features of the improved Scottish farming. In a subsequent number, while bringing before the notice of our readers the *Encyclopédie du Cultivateur* of M. Du Bois, we attempted to present an outline of modern French agriculture. It has occurred to us, that a statement of the manner in which the ancient Romans—a nation as civilised and as powerful as ourselves—conducted their farming operations, might form a suitable sequel to these two articles, and the more so because Italy, under the Roman Emperors, was the only great state that was ever dependant upon a foreign supply of food until the same chance has occurred to our country in our days.

The farming of the earlier Romans was miserable enough. Indeed, the earlier properties were very small, not much more than four acres, and almost entirely, if not entirely, cultivated by means of the spade. In the later times, however, to which we refer, the soil of Italy was divided into large properties, that belonged mainly to members of the Patrician and Equestrian orders. Unlike our modern plan, these estates were not, as a rule, sub-let to tenant-farmers, but were managed for the landlord, often under his personal inspection, by upper servants. Some farms, indeed, were let; and of those that were so, a small proportion, and those only in later times, were let to independent tenant-farmers after our present custom. Those were called *coloni* or free farmers; and such paid rent for the land that they held, stocked it themselves, and undertook to cultivate it according to a certain fixed rotation.

But when the proprietor did not manage his land himself by the aid of grieves, &c., he generally fell upon a different plan from this, and intrusted it to *politores* or *partuarii*, as they were indiscriminately called. These men invested no capital upon the farm, and the stock, implements, and slaves belonged to the owner. The politor, however, conducted all the farm operations, and received for his reward so much of the produce. This proportion varied very much in different farms, and was probably always dependent upon the quantity of arable land in proportion to that in permanent pasture. At any rate, the remuneration of the politor was always a proportion of the corn, and varied from one-fifth to one-ninth of the harvest. It is not known whether the politor found a corresponding portion of seed-corn or not; but if he did not, it may be calculated that, on average land, and with average management, he would receive for his share about 120 bushels of corn. That is to say, that if the politor system prevailed here at the present time, he would, on a farm managed according to a six-shift rotation, receive about 3s. 6d. per acre.

When a Roman proprietor cultivated his own lands, he employed grieves, free labourers, and slaves. Some of the opinions

held by the Roman agriculturist writers, regarding each of these three classes, may not be without interest. Cato, for example, preferred a grieve who could neither read nor write, upon the plea that such a man could not cook his accounts himself, and would be afraid to intrust that process to a third party. One qualification insisted upon by the same writer as necessary for a grieve, and one which, we daresay, all amateur farmers will concur in, is that he will not pretend to know that which he does not know, or be unwilling to learn that which he is ignorant of, ("in universum tamen hoc maxime obtinendum est ab eo, nequid se putet scire quod nesciat, quæratque semper addiscire quod ignorat.") The other ancient qualifications for a ploughman are not very much in accordance with our modern notions. He must, first of all, possess a terrible voice, and a roughness of manner that will keep his cattle in due subjection; and the taller he is the better, because, if ever he tire, he can, without stooping, lean upon the handle of his plough. Certainly, at present, we would not tolerate a man bawling to his horses; and it is generally observed that a very tall man makes a bad ploughman, entirely owing to this habit of leaning on the plough-handles. Common labourers, however, Cato decides, may be of any height, provided they are handy. The work of the vineyard, nevertheless, requires superior skill—and as, among free labourers, he fears those of the greater genius are the greatest rascals, he advocates the custom of cultivating them by means of chained slaves.

After Cato's time, this custom of cultivating land by means of slave labour became still more usual, and ultimately led to the ruin of Roman agriculture. The accounts that have reached us of the cruel treatment and barbarities sometimes inflicted upon members of this unfortunate class are revolting to humanity, and have perhaps unduly degraded the Roman private character in our eyes. And yet the ordinary physical treatment of the Roman slaves does not seem to have been very bad. Bread was the staple article of food, and from 4 to 5 lb. appear to have been the daily ration, the quantity varying according to the severity of the work. Their drink was wine; immediately after the vintage a light kind was fermented, to which they had probably unlimited access. They had likewise, on the average, nearly a bottle *per diem* of better wine. Then, in addition to the bread, they had an allowance of olives and other fruit; and in the seasons when these were not to be had, salted fish. Once in two years the slave was clothed, or, at any rate, he then received a pair of new shoes, a new coat, and another garment, which was perhaps, after all, a kilt. Still the treatment of the Roman slaves was a very cruel one, and they were essentially regarded as mere property.

The number of vegetables cultivated by the Romans was great; and it is curious to observe the various values put upon the differ-

ent crops. Cato held the vineyard to be most lucrative, then a willow plantation, after that an olive field, next grass land, then arable land; and after these, several kinds of timber plantings. In the arable portion of the farm they preferred planting on stiff land in good heart; and, which seems stranger to us, on this same land, if wet, they grew radishes and millet. They had an idea that seed for dry warm land should be taken from corn grown on cold wet soil. Wheat, as with us, was a principal crop, and they had an analogous grain called *far*, which is perhaps now lost, but which, possibly, was bere. They were aware that beans required a heavy soil. They cultivated also barley, oats, (these probably very sparingly,) a great number of leguminous plants, lucerne, rape-turnip, flax, &c. They were also very fond of raising crops merely for the sake of ploughing them in. Lupine and vetches were generally selected for this purpose; but they also ploughed in beans.

The Roman systems of rotation are interesting. Upon their best land they were fond of a four-course shift—viz., millet dunged; 2, radishes; 3, barley; 4. barley again, or wheat. Another rotation was similar to the one still used on very strong land in England—beans and far time about, manuring probably for the beans. Pliny even notices a still more scourging system—first millet, and then two crops of far. In land considered good, but not equal to the fore-mentioned, they took—1, corn; 2, beans; 3, some kind of pulse—manuring apparently for the beans. On still inferior land they had a fallow every five years; on yet worse they fallowed every third year; and on the worst of all, every alternate one;—and this last seems to have been the plan most generally followed.

The Romans were well acquainted with the value of manure. "What is the first thing in good farming?" asked some one of old Cato. "Ploughing well," he replied.—"And what the second?" "Ploughing."—"And what the third?" "Manuring well." The cattle were carefully littered, not only with straw, but with coarse grass, reeds, and weeds. One of their writers, indeed, maintains that a good husbandman ought to obtain, each month, from every one of his larger animals, ten cart-loads of manure—a quantity that appears incredible. The excrement of pigeons was carefully kept, and sown by hand; nay, what is more, that of sea-birds was tried, but not considered to be valuable. Of ordinary farmyard manure, an area corresponding to about a Scottish acre received about forty loads. Owing to a most extraordinary superstition, land was only manured when the moon was waning; and many were further of opinion, that it was also necessary that the wind should blow from the west. The Romans, it is proper to add, folded both sheep and cattle upon land intended for corn. Liming was unknown for long, and never probably extensively practised.

Oxen were the beasts of burthen and of draught mainly employed by the Roman farmers. Cows, likewise were used for this

purpose, and also, but probably to a very small extent, mules. A pair of oxen were attached to one plough, and the ploughman, besides holding the implement, drove them. A pair of oxen were assigned to from about 40 to 50 Scottish acres. They were broken in at the age of from three to five, the process being completed in a few days, and being attended by many absurdities. For instance, their noses were well rubbed, in order "that they might learn to smell a man;" their backs were sprinkled with new wine, "to render them familiar with the ploughman;" and, by way of conclusion, their tongues were seized, their palates rubbed with salt, cakes weighing a pound pushed down their throats; and, last of all, a pint of wine was administered. "By this soothing usage," says Columella, "he will in three days be accustomed to his keeper, and on the fourth receive the yoke."

In the cart as well as in the plough, oxen went in pairs; and although the agricultural writers condemn the custom, it is plain that they were very often yoked by the horns.

It was considered improper to make the furrow longer than 120 feet, and at each turn a rest was allowed, and the yoke was pushed forward that the place it had pushed against might cool. As far as regards their other treatment and their food, the Roman oxen do not seem to have had much to complain of. When their work was over, they were well rubbed down, and, if they were very hot, a quantity of wine was poured into their throats. Of course, in a grape-producing country like Italy, common wine would be a very cheap commodity. The Roman farmers were not unique in administering to their tired animals fermented drinks. Some years ago it was not uncommon in the North of England to give a horse, when making rather a long journey, a quantity of ale; and the writer of this recollects riding through certainly a remote district in company with two friends, and their horses being offered ale at a village inn, where they stopped to bait, almost as a matter of course.

Perhaps an abridgment of Columella's instructions for feeding work-oxen may not be without interest. The basis of their food was cut forage, hay, and straw; but, which is quite contrary to the modern opinion, barley-straw was preferred to wheat. But this was, perhaps, pretty much owing to the barley being frequently allowed to remain also. But, besides the straw, &c., the Romans supplied their working oxen with other food. In January, for example, each ox got four pints of bruised tares, steeped in water, mixed with chaff, or a peck of steeped lupines, or half a peck of vetches. If these latter-mentioned articles were scarce, a substitute that appears strange to us was adopted—viz., the skins and stones of grapes that had had the juice squeezed out of them. If none of these substances were conveniently to be got, a daily ration of thirty pounds of hay was given. A like diet did for February.

In March and April, owing to the harder work, forty pounds of hay was a daily ration; and if other diets were adopted, we suppose that they too were increased in proportion. From the middle of April to the middle of June, and sometimes later, green forage supplied the oxen with food. From this time to the beginning of November, the leaves of trees constituted a considerable portion of their sustenance. As these are utterly unknown to us as food, perhaps we had better quote Columella upon this point. "From the 1st of July to the 1st of November, throughout the summer and autumn, there is an abundance of leaves, which, however, are not good until they have been wetted with rain or dew. The best are those of the elm, then those of the ash, and next those of the poplar. The worst are those of the holly, the oak, and the laurel; but towards the close of the season, as the others fail, these must be used. Fig-leaves may be given, if it is thought prudent to strip the trees of them. Oak-leaves are inferior to the holly *without* thorns; for the round holly, as also the juniper-leaf, is rejected by cattle owing to the prickles." November and December, being the autumnal seed-time, put additional labour upon the oxen; and during these months, Columella states that they ought to have no stint; but he adds, that it is generally considered sufficient to give them, with straw *ad libitum*, a peck of mast—*i.e.*, acorns and beech-nuts—or a peck of steeped lupines, or seven pints of tares, sprinkled with water, and mixed with straw, (*permisti paleis*, a curious anticipation of a recently proposed plan,) or a peck of grape-stones; or, if none of these are attainable, forty pounds of hay.

With regard to the nutritive value of leaves and mast we are ignorant; but, upon the whole, the above scale of dietary is a liberal one; and two Roman oxen appear to have tilled as much arable land as two of our horses. But it was doubtless tilled in a very inferior manner; for the Roman implements of agriculture would appear to have been very imperfect ones. The Roman plough, for instance, seems to have been an inefficient instrument, and to have been almost as much of a grubber as a plough. It, moreover, had only one stilt; and we can easily fancy that the *bubulcus*, as the ploughman was called, chosen for his rough voice, would play a poor figure at a modern ploughing-match. It is curious to notice, that these *bubulci* sometimes played their employers tricks, and that one of them consisted in leaving spaces between the furrows—what we would call "baulks," but which, according to Columella, were named by the Romans *scamna*.

The crops obtained by the Roman cultivators of the soil were never great, and became much less during the Empire. In Varro's time—and Varro was contemporary with Cæsar—an acre of ordinary land yielded rather better than 21 bushels of wheat, and the same area of the best land about 32. This was about eight or ten times the seed sown. Yet when Columella wrote, and he lived in the time

of the Emperor Claudius, there was no land, as he declares, that produced four times its seed. Indeed, Columella begins his book by considering the question, as to whether the land had lost its fertility or not; deciding, however, that the deterioration is owing to the incapacity of the cultivators. The consequence was, that the price of wheat was very much raised; a quarter that, in Varro's time, sold for little more than a pound, fetching, in Columella's, (or, at any rate, in Pliny's, who lived almost contemporaneously,) more than £3, 2s.

The crops obtained from meadows, and the general management of the haymaking in the Roman times, are not without interest. It was considered to be a pretty good day's work to mow rather less than half a Scottish acre. This may in part, perhaps, be ascribed to the inferiority of the scythes; but it must also, we suspect, be partly referred to the less physical strength and power of the Roman labourer, as compared with those of our rural population. Two kinds of scythes were employed: one, probably, resembling ours, and requiring two hands to wield it; the other a smaller affair, and more approaching, probably, to the character of a hook. For some time these were sharpened by means of Cretan whetstones, that could not put a sharp edge upon the scythe without the use of oil. Accordingly, every mower had a horn containing oil, fastened to one of his legs. Afterwards, however, they became acquainted with scythe-stones such as we use. The Romans made their hay well, turning it incessantly with forks until it dried, then made it up into bundles, and carried it home. About 260 stones, of 22 lb. to the stone, appears to have been a usual crop from an area equivalent to an English acre.

The Roman farmers were quite aware of the unprofitable nature of keeping land too long under grass. When they considered that pastures were becoming unremunerative, they ploughed them up and took a crop of corn, which crop, they generally noticed, was a good one; they then took a crop of turnips or beans, for which, we presume, they manured; then another white crop; and then, after a thorough ploughing and weeding, they sowed vetches mixed with hay-seeds. The surface was then carefully smoothed, the vetches not cut until they were very ripe; and no heavy cattle were allowed to go upon it for two years, for fear that they would poach the young turf.

For a long time the Roman fields do not seem to have been enclosed, and the live stock was probably herded just as we sometimes see it now herded in remote parts of this country. Subsequently, however, they employed all the means of enclosure at present in use. The farms were likewise drained, the majority of the drains being open ones; but some were partially filled with stones, or, if these could not be conveniently got, rods or twigs of willow. The depth of the drains varied from 3 to 4 feet.

Still this drainage cannot have been very effectual, inasmuch as the labourers are directed to be sent on the land with hoes, &c., to open the drains and cut channels.

The Romans systematically cut their corn before it was ripe, and they did this partly to avoid loss by shaking, &c., and partly from a notion that they seem to have had, that by thus acting, they increased the crop. Various modes of reaping were in use. Sometimes the straw was cut close to the ground, and the corn laid on the ground in handfuls. A person going after then cut off each ear and carried it away to the thrashing-floor, and the straw was afterwards stacked. Another plan differed still more from our usage, by means of an implement called a *batillum;* a bunch of ears were seized, and cut off at a stroke, the whole of the straw being left standing, to be cut afterwards. The destruction of the straw in this manner by the feet of the reapers must surely have been very great. A third plan was to cut the straw in the middle. It is a very curious fact, that reaping-machines were unquestionably employed in the Roman empire. More than one kind is mentioned by Roman writers. The following is Palladius' description of one: "In the plains of Gaul," he writes, "they use this rapid mode of reaping, and, without human labour, with the aid of an ox reap a large field. To effect this, a machine borne on two wheels is made; the square surface of this has boards at the sides, which project outwards and make a larger surface above. The board at the front is lower than the others, and upon it are a great many small teeth, set wide in a row, and corresponding to the height of the corn, and turned upwards at the ends. Two short shafts, similar to the poles of a litter, are fixed to the back part of the machine, and to those the ox is yoked, with his head turned toward the machine, the position of the yoke and traces being also altered. The ox requires to be well trained, and not to go faster than he is driven. When this machine is pushed through the standing-corn, all the ears enclosed by the teeth are gathered up in the hollow part of it, and cut off from the straw which is left behind. The driver requires to set the machine higher or lower as he may find it necessary; and in this manner, by a few courses backwards and forwards, in a short time the whole field may be reaped. This machine is very useful in champaign and level countries, and on farms where the straw is not required."

Such may serve for an outline of some of the processes of Roman agriculture. English readers desirous of knowing more regarding it will find an ample account in Dickson's *Husbandry of the Ancients*, a work of great learning, but ridiculous from its determination to praise every classical custom.* With one remark we

* A more succinct and accurate account of Roman agriculture, than in Dickson's *Ancient Husbandry*, is to be found in SMITH'S *Dictionary of Antiquities*, by Professor Ramsay of Glasgow.—EDITOR.

will close this paper. It is clear from the history of Roman agriculture, that the farming of a country that does not otherwise go back in civilisation may deteriorate to a most enormous degree in the course of a very short period. One of the causes, perhaps, of its falling off was the diminution of free labour, and the substitution of slave for hired labourers. And we are not sure if the superiority of the farming of Scotland to that of many other civilised countries, is not, after all, more to be attributed to the superior intelligence and social position of the Scottish farm-labourers than to any other cause.

*Johnston's Elements of Agricultural Chemistry and Geology.**—The expression "scientific agriculture," as now commonly used, is not strictly accurate. Speaking precisely, scientific agriculture means any application of science to farming. The abolition in Scotland, for instance, of cumbersome and inefficient implements, entirely from reasoning afforded by the science of mechanics, was an example of scientific agriculture, and one that has unquestionably materially lessened the cost of production to the farmer. The system of drainage, which has increased the productive value of the soil by many bushels per acre, was an application of the science of hydrostatics. But it is evident that the appliances of mechanics and hydrostatics to the art of the husbandman are limited, and, save as mere matters of detail are concerned, have reached the full extent of their usefulness. Of late, those sciences that endeavour to unfold the relation that the soil bears to the crop, that the crop bears to the animal, and that which the geological formation of the district bears to the soil, have attained so great and so just a prominence, that the term "scientific agriculture" is now nearly confined to them; and we say, that the improvements that are to take place in practical agriculture will come from the investigation and application of the principles of chemistry, of geology, and of physiology.

And yet this conclusion, to which we have all, or nearly all, now arrived, has only been quite recently come to. A very few years ago—nay, almost yesterday with some—the majority of the most intelligent and experienced of our farmers denied that these sciences were able, or were likely to be able, to beneficially influence their art. And no wonder, for among the purely scientific men, there was not one that could, fifty years ago, suggest any improvement in agriculture, or even explain ordinary agricultural phenomena. Nay, more; a little more than twelve years ago, these sciences could not, in the closet, account to the farmer for what was going on in his fields and cattle-houses.

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* *Elements of Agricultural Chemistry and Geology.* By JAMES F. W. JOHNSTON, F.R.SS. L. & E. Sixth Edition. Blackwood and Sons, Edinburgh and London.

The gradual rise and progress of this scientific agriculture may be told in a few sentences, and is not without its interest. Although one or two individuals had suspicions of the truth, until the time of Saussure no one knew of what vegetable structures were composed, or what constituted the difference between the various kinds of plants. Men saw, indeed, an acorn become converted into a huge oak, or a grain of wheat into a wheat plant; but save in external appearance, the difference between the plant and the seed from which it sprang was quite obscure; and the mode in which the tree or mature plant acquired its increased bulk was regarded as altogether occult. Fifty years ago, Saussure experimentally determined that plants were composed of various elements common to them and the soil and atmosphere around them, and that the difference between the various species of vegetables was owing to the different quantities of these chemical elements that the different species respectively consisted of.

It seems strange that the importance of this discovery was not immediately seen and acted upon. Neither, however, was the case. On the contrary, experiments were made and repeated, all of which tended to show that plants attained their structures in a mysterious manner; and it was even maintained that water, which we know is composed of two elements, oxygen and hydrogen, could supply to the growing wheat or oak the additional bulk that they were evidently acquiring. Eighteen years after Saussure had announced his discovery, Mr Grisenthwaite very plainly declared his belief that the different species of vegetables were composed of either different chemical elements, or of the same elements in different proportions; that these were mainly derived from the soil; and, as a natural consequent upon these statements, this gentleman propounded the doctrine of specific manures. We may also observe, that Mr Grisenthwaite first employed the expression *specific* manure.

Still, the subject received no attention either from scientific men, or from those concerned in the cultivation of the soil. At length Liebig announced the fact; and partly owing to his fame as a chemist, but partly, we think, because men's minds had become ripe for receiving the discovery, it obtained almost universal credence among scientific men. Liebig, however, to the doctrine, unquestionably true, of the mineral constituents of plants, and of the importance of mineral manures, added peculiar, and almost certainly erroneous, opinions respecting the source of nitrogen to plants. In fact he spoke, and, what was worse, acted too decidedly; and his mineral manures proved an utter failure; and to the over-excited hopes of the farmers succeeded a sullen incredulity.

Indeed we hold that, as the new scientific agriculture was not first taught by Liebig, so also its present standing and success is

attributable to the genius and labours of the school of chemists that accepted the more important of the views that he so enthusiastically promulgated. First and foremost among them is Johnston. He appeared on the field so early as to rank more as an original thinker than a disciple. If he were a follower of Liebig, he did not follow him into his errors; and in many—and some of these having the most important practical applications—he is quite original. Scientific agriculture would now probably have had a being had Liebig never lived; but we could not, in this country, have wanted Johnston. Ten years ago he published the first editions of his *Lectures* and *Elements;* and now, when he offers the second of the former and the sixth of the latter, we know not whether to admire more the additions in matters of detail that he has made in the interval, or that sound judgment that he showed at starting, and which is indicated by the fact of so much having been added, and yet so little altered.

Our purpose, however, here, is not so much to consider the general scientific character of Professor Johnston, as the work now before us, which, from its additions and enlargements, is essentially a new work. Before doing this, however, it may be proper, inasmuch as some even yet doubt of the existence of a scientific agriculture, to consider, after a homely fashion, the evidence that we have for its reality.

A farmer, we will suppose, has a field measuring 10 acres, and situated near a town. He purchases 300 tons of police manure, which he incorporates with the soil of that field. He sows upon it some 30 lb. of turnip seeds; and in the course of six months we find, if we examine that field, a good deal of the manure is not appreciable to the senses—has disappeared, in fact; but that, upon the surface of the drills, 300 tons of turnip bulbs are present. Notwithstanding, too, the immense bulk of the manure laid upon the field, the surface is little or no higher than it was before. The empiric may talk as he pleases about the "strength" of the manure, its "stimulating effects," and so forth; but if we impartially watch what has taken place, we must admit that what in May was police manure, is now actually and *bonâ fide* turnips.

If we remove these turnips, and add to the field 300 tons more police manure, the farmer can next year produce 300 tons more turnips. In like manner, if he choose to plough in his crop of turnips, he could the next year obtain a similar crop of turnips. That is to say, he can, if he likes, in the year 1850, convert 300 tons of manure into 300 tons of turnips; and in the year 1851 he may, if he choose, convert these 300 tons of turnips into a new crop of the same weight.

If, however, he go on trying to grow turnips upon this same field without adding something, his crop gradually falls off, until it becomes worthless.

Or a somewhat analogous experiment may be performed within doors. Two geraniums may be taken, the one a large full-grown one, and the other a very small young plant. If the larger one be cut down and buried, it is mainly resolved into some ashes and a large quantity of gas, which is carbonic acid, and which may easily be collected into a jar. If the smaller geranium with its earth be introduced into this jar, the carbonic acid will gradually disappear, and the young geranium will become larger—that is, the carbonic acid that formed part of the structure of the old geranium, now forms part of the structure of the younger one. In the same manner, if we take the ashes of the old geranium, and mix them with the soil around the roots of the younger one, they too disappear; and if we wish to again obtain possession of them, we must seek for them in the enlarged structure of what was the small geranium. If we choose to proceed, we can destroy by fire this young geranium, and convert its substance into another geranium, and repeat this process as long as we liked.

Now scientific agriculture not only affords us an explanation of these experiments, but likewise suggests means by which the largest acreable crops may be produced at the least possible expense. A crop of turnips consists of a union of so many chemical alimentary substances, which are derived partly from the air, but mainly from the soil. If we bury a crop of turnips in the ground, we can of course, from the soil of the field where we bury it, extract, in the following year, a similar crop. But as police manure consists of exactly the same chemical elements as rotten turnips, and is much cheaper, it is to the advantage of the farmer to buy the cheap manure, and convert it into more valuable turnips.

The explaining of the action of manures upon growing crops is but one of the offices of scientific agriculture. A portion of the food of plants, and therefore a part of their subsequent structure, is derived from the atmosphere: scientific agriculture makes the laws that regulate all this manifest. Moreover, the insoluble subsoil is gradually becoming soluble soil, and as capable of being turned into crops as police manure is: this also scientific agriculture elucidates. Nay, more; the changing of manure and of soil into crops, is not the only transmutation the farmer has to make: he must further convert a portion of these crops into butcher-meat —beef, mutton, veal, and the like; and upon this complicated process scientific agriculture throws great light, and is upon the verge of being able to suggest great improvements. These are by no means the boundaries of scientific agriculture, but we enumerate them as the most prominent; and we have no hesitation in affirming that, as the applications of the science of mechanics, &c., during the generation that has passed, has increased, and that materially, the amount of food produced in our island, so also will, in the generation that now is, the application of the new scientific

agriculture increase, and to a great extent, our existing averages.

How, then, is this scientific agriculture to be brought to bear upon actual farming? Is it by the actual cultivators of the soil becoming proficients in geology, in chemistry, and in physiology? It is impossible, and perhaps not advisable, that this should happen. Men in mature life—and the great majority of those concerned in the cultivation of the soil were such, ere even the expression agricultural chemistry was known—very rarely learn sciences. Moreover, those who live in towns, and are accustomed only to habits of city life, have a mistaken idea of the practicability of farmers, as a general rule, becoming very conversant with science. A scientific man, living in a town, has nearly all his time to dedicate to scientific pursuits. If, for a livelihood, he have to lecture, or to analyse, or to work for the press, all these occupations, so far from diverting and distracting his attention from scientific pursuits, only render his knowledge and judgment regarding them more accurate and defined. This is not the case with the farmer. One day in the week, at least, he must be at his market town; and so situated in this respect are many of our farmers, that this will occupy the whole of the day. Fairs, and unavoidable absences on business, may fairly be set down as absorbing another day more. Then, at least in Scotland, Sunday is invariably observed as a day of complete rest in the country; and there is not perhaps a farmer in the land who would study on that day. Thus, three days out of the seven are occupied. The quantity of out-door labour that necessarily falls upon the farmer on the remaining four days is very great. No business, perhaps, requires such constant personal superintendence as farming. Besides, crops advance and fall back so frequently in this climate that we cannot wonder that few farmers can resist making even somewhat unnecessary personal inspections. We certainly hope to see the time when every district shall possess one or more farmers familiar with agriculture, and able to set an example; but we never expect to witness a period when every one conducting farming operations will be so.

Take, for instance, the medical practitioners of Scotland, a class of the community universally and justly esteemed. Their art is based upon the same sciences as agriculture ought to be; and yet we will venture to affirm, that there are not twenty of them practising in the country, whose education was finished a dozen years ago, who have fairly kept up with the progress of chemistry and physiology in the interval. Nor are there twenty of them capable of originating an improvement. Yet they know enough of science to appreciate a scientific discovery when made; and they invariably adopt those improvements that science dictates to practice. We desire and hope soon to see a similar state amongst the agriculturists.

But how are the existing race of farmers to acquire such a knowledge? Is it by means of lectures? We certainly believe that, by the majority of men, an extensive knowledge of any science is only to be acquired by attendance upon lectures; and we think the admirable results that we see flow from the mode of teaching adopted in the Scottish universities fully confirm the truth of this opinion. But although we may hope that the rising generation of farmers may avail themselves of this mode of instruction, it is clearly quite out of the question as far as regards those actually engaged in conducting agricultural details. It is by means of books, by affording a scientific agricultural library, that existing farmers may acquire a knowledge of the truths and doctrines of the new scientific husbandry. A lecture is delivered at a precise hour on a certain fixed day; but a book is always at hand, alike in a chance hour of leisure, a storm, or a winter's night; and if the existing agriculturists are to obtain a knowledge of what science has ascertained regarding the present state and prospects of farming, it must be through the medium of the press. Two classes of books upon the science of agriculture have appeared. One, like, for instance, Johnston's *Lectures*, is only suited to those who already possess some scientific knowledge; while the other, like that now under our notice, is adapted for the use of any one having ordinary intelligence and the desire to learn. It is so plainly and elementarily written, that there is not a farmer in the country who may not, if he choose, obtain a clear, and indeed an enlarged, notion of the sciences of chemistry and geology, and of their applications to the culture of the soil and the raising and fattening of stock.

Indeed, the good that this work must have done is almost incalculable. In Great Britain ten thousand copies have been sold. Assuming that each copy has been perused by six individuals, that gives sixty thousand people, nearly all of whom would be connected with the soil, who have had an opportunity of benefiting by its contents. But this is not all; many more copies have been sold in America; and there is scarcely a European language into which it has not been translated. Such being its success, it is no wonder that its author was stimulated, when preparing this its *sixth* edition, to bestow the great labour that he has done upon it, in order to render it even more methodical and more complete than it was. The work is greatly extended: from containing fifteen chapters, it has now expanded to twenty-five; the number of pages is greater by a fourth; several more engravings are presented; and in almost every paragraph there are additions and corrections that bring up the information presented to the present state of knowledge and opinion.

Although such is our opinion regarding this work, we deem it unnecessary to enter into its details, since Professor Johnston's

style, perspicuity, and lucidity of arrangement are already so well known to our readers. All we shall say further is, that no farmer's book-shelf can dispense with this sixth and enlarged edition of the Professor's *Elements of Agricultural Chemistry and Geology.*

Webster's Ireland as it is.—(Continued from p. 594.)—Let us turn now to the ethnographical part of our subject, and glance briefly at the incomprehensible, or at least ill-comprehended, race which has so long made Ireland "England's difficulty."

Idleness and improvidence are the besetting sins of the Irish, and these defects have been rather too rashly laid at the door of their Religion, or of their Race. The carefully irrigated and fertile plains of Lombardy—the high cultivation of the vale of the Arno, densely peopled with industrious, contented, and thriving inhabitants—and the skill and industry which maintain the agriculture of Flanders among the first in Europe, may well prove that the religion of the Irish offers no insuperable barrier to improvement; while the alleged inferiority of the Celtic race is a gratuitous assumption, directly contradicted by Dr Daniel Wilson, one of the highest authorities on the subject. In our opinion the Celts are equal, perhaps superior, to any other pure race that ever existed; but, as each race has its own peculiar excellences and defects, this does not prevent us from holding that those tribes in which the Celtic element predominates are more fickle, and less capable of sustained efforts, than their Anglo-Saxon brethren. Mr Pim, in his work on the "Condition and Prospects of Ireland," remarks:—

> We see that Irishmen succeed in America. Why do they not thrive at home? In America they are certainly on a level with all their neighbours; they have a fair field and no favour; and there they are industrious, and reap the fruits of their industry, in the acquisition of property and the respect of their fellow-citizens. Here the labourer earns a bare subsistence, by precarious employment at low wages, with but little hope of improvement, and consequently but little stimulus to exertion. When he crosses the Atlantic, the improved chances of success arouse his energy, he assumes a new character, he feels the necessity of exertion, and proves himself equal to his new position.
>
> It has been asserted that even in America the Irish are to be known by their idleness, their want of cleanliness, and their improvident habits. It is true there are many who never rise out of the faults of early life; but these are exceptional cases, and that the great majority are industrious and saving, is proved by the amount of remittances in sums, small in themselves, but large in the aggregate, made by Irish emigrants to their friends and relatives at home. A correspondent of the writer's has informed him, that having made inquiry from the various banking-houses in New York, and in Philadelphia and Baltimore, he found that the remittances by small orders, from £1 to £10, made by Irish emigrants to their friends in Ireland, in the year 1846, amounted in all to 1,000,000 dollars, or £200,000 sterling. These remittances, coming from working men and women depending upon their daily labour for support, prove at the same time their industry, their economy, and that love of kindred which absence and distance cannot efface. Many of those remittances were sent to enable a relative to follow in the same path, to a land where industry has free scope and a sure reward. The husband sends home the means which may enable his wife and children to follow him; the child sends for his parent, or the brother for his sister; and in this manner many whole families have gone, one after the other, to seek a new home in the West.

That a manifest social change for the better is taking place in Ireland itself, we shall by and by show; but meanwhile let us examine a little further into the causes which have so long retarded the progress of the Irish Celts. One of these, certainly, is the *isolation* in which they have always existed—an isolation which fosters their antipathies to Saxon civilisation, and which, viewed in this light, may be considered the fountain of all their evils. The leading principle, therefore, to be kept in view in all remedial measures, is the removal, by all possible means, of this state of isolation, and the blending of the natives with the more industrious and prudent race who long ago had the misfortune to conquer them. "Left as he is, under Saxon rule," says Dr Ellis, "unaided and easily discouraged, the Celt will not improve even in his own way. Show him, by example, the value of labour, the necessity of order, the advantages of knowledge, and the comforts of a higher scale of living, and he will be found quick to learn and skilful to perform; and though always retaining his excitable temperament and peculiar tendencies, his facility in accommodating himself to surrounding circumstances, when the curse of isolation is removed, and the strict enforcement of law secured, will effectually adapt him to the enjoyment of true liberty, and Saxon modes of civilisation and progress."

One of the main causes of the system of agrarian outrages which has so long disgraced Ireland was, that in former times a life-lease of a house or land in which the lessee had an interest worth forty shillings a-year, called "a forty-shilling freehold," entitled the holder to a vote; and this low franchise induced the landed proprietors to divide their estates into many small holdings, for the purpose of increasing their influence at elections. The consequence was an increase of population without a corresponding increase of the means of support; and no sooner were these freeholders disfranchised, at the passing of the Emancipation Act in 1829, than, being no longer of use to their landlords, every means was employed to get rid of them. The extraordinary emigration that has been going on from Ireland, and which is likely to continue for some years to come, cannot fail to remove that excess of population from which the system of agrarian disturbances mainly sprung; and the improved style of agriculture now being introduced, and the market for labour thus opened, will, it is to be hoped, ere long exterminate agrarian violence altogether. "It is a remarkable testimony to the improvement effected by such works in the social habits of the people," says Arthur Young, "that the district between the Shannon and the Blackwater, which was opened in four directions by the roads executed by Mr Griffith, although formerly the seat of the Desmond Rebellion, and subsequently, in the year 1821, the asylum for Whiteboys, and the focus of the Whiteboy warfare, during which time four regiments were

required to repress outrage, became perfectly tranquil, and continued so up to the commencement of the late calamity." Employ, don't hang them, is the rule now being adopted; and we believe it will prove an efficacious remedy.

It is an almost universal belief, on this side the Irish Channel, that in Ireland there is no security for either life or property. Mr Webster warmly opposes this opinion; and although he has by no means succeeded in inducing us to participate in all his views on this point, it must be allowed that within the last few years the Irish peasant has made an immense advance on those habits which are most conducive to correct conduct and industrial success. The existing generation is half a century in advance of that dying off, while the one now at school promises to be nearly a century (an Irish century, of course) before the present. The people *were* idle, reckless, and ignorant, for they had little or no inducement to be otherwise; but temperance-halls and village-schools are now reversing all this, and constant employment alone is wanting to establish in a fairer light the real character of the working Irish. "In Avoca, some years ago," says Mr Webster, "upon pay-days five hundred gallons of whisky were regularly consumed by the two thousand men working the mines; the night, as a natural consequence, being spent in fighting, while the wives and children begged in vain for a share of the wages for food and clothing. No whisky whatever is now sold upon pay-days, and the wives of the men receive for them. In many other parts of Ireland the same thing takes place, and there is a complete change in the character of the people."

For more than a twelvemonth Mr Webster had upwards of a hundred men employed upon one estate, under the superintendence of an English foreman, and the account he gives of the conduct of the workmen is very encouraging. They were never allowed any irregularity, either in coming to or leaving their work; there was no disturbance during the whole of the time they were so engaged, and, wonderful to relate, not a man was allowed to smoke while at his work. They were, of course, regularly paid, at the rate of from 7s. to 9s. a-week, and altogether they were fairly treated and judiciously managed. In return for this, Mr Webster was neither shot at, nor yet threatened; nay, more—on leaving the district they raised a subscription amongst themselves, and presented him with a handsome silver-mounted walking-stick, having his name engraved on it, as "a tribute of Irish gratitude to English worth."

In regard to the Poor-rate, which during the famine-years sometimes absorbed nearly the whole realisable rental of an estate, Mr Webster says that there is now little or nothing to be dreaded from it. In the course of a tour which he made through almost every county, with the object of looking at estates, in no one in-

stance did he find the rate to exceed 4s. per English acre, although it had often been double or treble that amount; and the average for all Ireland, he assures us, is now not more than about 1s. 9d. Thus everything unites to improve the prospects and strengthen the cause of order in Ireland. The disaffected and unthriving are being drafted from it; and a most efficiently organised police force, combined with the English and Scotch settlers, must quickly suppress any lingering system of intimidation that may yet remain. And so, we think, the interesting and carefully digested facts adduced in this valuable little work fully bear out the prefatory statement of the author, that "the vast amount of capital now vainly seeking profitable investment, may be employed in the purchase of land in Ireland as securely, and more profitably, than in any other part of Great Britain."

*Gray's Rural Architecture.**—It has been well observed by the authoress of *The Pearl of Days*, herself a labourer's daughter, that where whole families are crowded into one apartment, common to every domestic purpose, the difficulties such a dwelling presents are calculated to smother the desire of intellectual improvement; that it is hardly possible for intelligence, piety, or even morality, to exist in the narrow, crowded dwellings which many of the working classes of this country inhabit; and that confined, ill-ventilated abodes, surrounded by every outward auxiliary to vice and disease, are poor nurseries for the young, whether we regard their bodily or spiritual nature. No one, we think, will gainsay the truth of these remarks; and the improvement now becoming general in the construction of dwellings for our rural population is one which has for long been demanded by the exigency of the case. Yet this movement is only in its infancy, and must advance step by step, along with those other well-directed measures which are still continuing to alter for the better the face of the country. Nothing can be more incongruous than to see, as we sometimes do, "high farming" carried on amidst ill-arranged or even ruinous farm-offices; and it is satisfactory to observe, that every year landlords are exhibiting a greater desire to provide suitable accommodation for the tenant and his dependants. To assist them in this good work is the object of Mr Gray's *Treatise*, and it is the fullest on this subject that has yet met our eye. It comprehends ground-plans, elevations, and sections of existing houses, offices, cottages, and farm-steadings; as well as plans of manses, schools, gates, railings, &c., with specifications, and all necessary information as to the cost of their construction. The author has succeeded in his object of making his work one of practical reference;

* *A Treatise on Rural Architecture.* By W. J. Gray, Architect, Coldingham. Edited by W. J. Fyfe. Edinburgh, 1852.

and his plans and descriptions ought to be intelligible to every country workman.

*Talpa's Chronicles of a Clay Farm.**—This is a most racy and delightful volume, as full of exquisite humour as of useful science, and illustrated by the matchless pencil of Cruickshank, who seems to have been inspired with a most happy flow of grotesque fancies when thus treating *de re rusticæ.* "Ridentem dicere verum" is the motto of the author; and he is certainly one who, besides the attainment of elegant scholarship, possesses, in a most unusual degree, the opposite faculties of the imaginative and the practical. His work defies criticism, both on account of its peculiar character and of its excellence.

In his dealings with his obdurate Clay Farm, the author discarded from the first all timidity, and seems to have been actuated much more by the *à priori* spirit of the Platonic mode of investigation, than by the slow and tremulous inductive system of Bacon. "A blessed thing, in its way," says he, "is the untamed boldness of youth. And nothing but the inconceivable daring of pure unmitigated THEORY would have ventured its character upon such a throw" as that detailed in the humorous account of the regeneration of a "wet clay" field, which had baffled every effort of preceding generations. We advise our readers to peruse the account in the author's own pages.

Improved Ventilator for Feeding-Byres, Stables, Granaries, &c., by Mr JAMES D. FERGUSON, Agent to W. B. Beaumont, Esq., M.P. for South Northumberland.—The importance of a proper system of ventilation in the habitations of all animated creatures, is now so thoroughly admitted, that it seems superfluous to enter here upon any disquisition of its merits. But although all may be satisfied of the fact that, for either man or beast to enjoy perfect and sound health, it is essential that they be placed in circumstances where that pabulum of life—atmospheric air—can be kept at all times under proper control, yet various are the modes employed to attain this important object in the best manner. While some experimenters recommend the admission of the fresh air to an apartment, at a low level, others propose it at heights approximating to that of the apartment. For human dwellings, where open fires especially are in use, the latter modes may be the most convenient; but for the present object, as it points more particularly to the live stock of the farm, the proposed improvement is confined to that alone. It is conceived that the most effective ventilation of a feeding-byre will be obtained by admitting the supplies of fresh air from below, either by open-

* *Talpa; or, The Chronicles of a Clay Farm. An Agricultural Fragment.* By C. W. H. London, 1852.

ings in the walls, or by air-conduits formed under the floor, furnished with grated covers, at proper intervals. Either of these, when combined with the ordinary luffer-board ventilator, placed on the ridge of the roof, will yield a full supply of fresh air—yea, more than may be desirable; for it will be evident that this arrangement leaves the supply uncontrolled, until some check to the current can be applied either above or below. To obviate this inconvenience, and to obtain a system of ventilation for the feeding-house, &c., at once certain and uniform in its effects, and embracing no complicated machinery or apparatus in working, has been the sole object in the arrangement here proposed. It is, in fact, nothing more than the adaptation of simple valves of deal to the ordinary roof-ventilators, where they thus become a very effective *regulator* of the ventilation when so applied.

The annexed figures, 1 and 2, will serve to convey a more correct notion of the arrangement than a mere verbal description can afford of the action of the regulators.

Fig. 1.

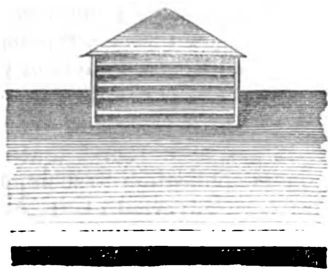


Fig. 2.

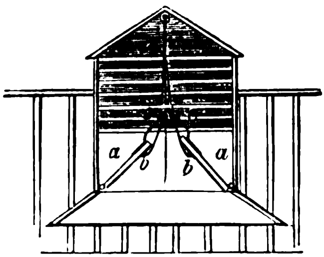


Fig. 1 is simply a front elevation of a portion of a roof and wall of a byre or other building, having on its ridge an ordinary ventilator, with fixed luffer-boardings. Externally, there is no essential difference between the old and the improved construction. Fig. 2. is a vertical section in the longitudinal direction of the roof, and cutting down through its ridge. Here the shell of the ventilator is seated upon the roof in the usual way. Its interior dimensions may be about 3 feet by 2 feet, and 3 feet high. A continuation of the void of the ventilator is carried downward with light close boarding, forming a chamber, *a a*, in which the regulator operates; its interior dimensions being, as above stated, 3 by 2 feet, and about 2½ feet deep below the apex of the roof. At bottom the chamber spreads out on all the four sides, taking the form of an inverted funnel, the better to receive the upward current of heated or vitiated air from below. Immediately at the bottom of the chamber, and where it begins to spread out downward, the two valves, or doors of light deal, are

hinged at *b b*. They are fitted neatly into the chamber, so that when let down to the horizontal position, the two, meeting in the middle, fill up exactly the horizontal area of the chamber, and the upward flow of air is stopped for the time. To each valve, and near to its free edge, a cord is attached, by which the valves can be raised. The two cords are joined at a short distance upward, and then pass on as a single cord towards a pulley fixed in the apex of the ventilator, and over which the cord passes to descend thence to any convenient point within reach of a person's hand. By pulling the cord, the valves are raised to any desired amount of opening, when a loop at the end of the cord applies to any one of a series of pegs, to retain the valves in the position required. To the back of each valve is attached a small loaded lever, *c c*. The only use of these is to secure the descent of the valves whenever the cord is slackened for the purpose of reducing the flow of air through the ventilators.

It will be obvious to the reader that the number of such ventilators must be proportioned to the extent of inclosed space requiring to be purified; and it will be also obvious that this mode of regulating implies that the roof of the building should be somewhat close, so that all the flow of air shall pass through the ventilators. The principle, therefore, applies with complete effect in those feeding-houses wherein modern improvement has been carried to the highest point. Since the idea of this regulator of ventilation first occurred to the proposer, it has been found that the principle is not altogether new; but in its application to such agricultural sanitary arrangements as are here adverted to, it is still believed to be new.

AGRICULTURAL ARCHITECTURE AND ENGINEERING.—No. VIII.

By R. S. BURN, M.E., M.S.A., Author of "Practical Ventilation," "Hints on Sanitary Construction," &c.

(*Continued from page* 516.)

IN accordance with our pre-arranged plan, we shall now proceed to notice the various materials required for building, and the most economical and simple methods of using and arranging them. And first as to *bricks* and *brick-setting*. Bricks are of various kinds, those most generally used being known as "malms," "seconds," and "stock." The malms are the most superior kind, of a pale yellow colour, and only used for the fronts of superior houses, and for the best description of brickwork; seconds are used for the fronts of superior houses; stock-bricks are generally used, and are of different qualities. There are numerous other

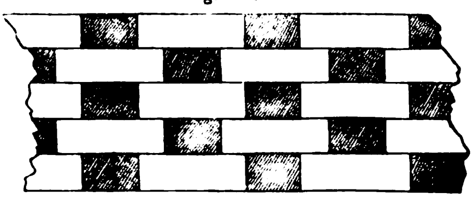
sorts, depending for their peculiarities upon the locality in which they may be made, as the blue bricks of Staffordshire. "Cutters" are soft bricks, capable of being cut into any desired shape. Bricks are set in two ways, each securing a particular kind of "bond;" there are "Flemish bond" and "English bond." The term "bond" is used to denote the method of superposing bricks, so that the joints of any one course are placed opposite the solid part of the bricks forming the course either above or below it: this is termed "breaking joint." Bricks placed so that their length corresponds with the line of wall, are called "stretchers;" those placed at right angles to the line of wall are termed "headers:" thus *a* in figs. 132 and 133 is a stretcher, *b* a header. Each row

Fig. 132.

Fig. 133.

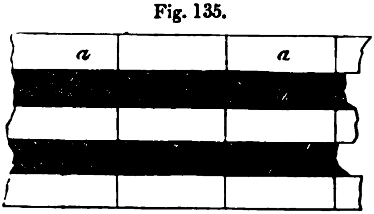
of brickwork thus formed is termed a "course," the regular thickness of a brick being three inches; each course is thus confined to the same height. In Flemish bond, headers and stretchers alternate in each course, the headers of one row resting on the stretcher below. Thus in fig. 134 the plain parts are

Fig. 134.



the stretchers, and the shaded parts the headers. English bond consists of one row of stretchers and one row of headers, in alternate rows. Thus in fig. 135 *a a* are the stretchers, and the shaded parts, *b*, *b*, the headers. Flemish bond is reckoned to be neater in appearance, from the manner in which the joints are disposed; but in consequence of there being a predominance of stretchers over headers, the lateral tie throughout the wall or bond is weaker than in

Fig. 135.



English bond. Old English bond, as it is sometimes termed, being therefore the strongest, we would recommend its adoption in all cases. The difference in appearance is so very trifling, that we venture to say that ninety-nine out of a hundred observers will be unable to tell, viewing both kinds, in what the difference consists. Brick walls are apt, if carelessly constructed, to "give" in two ways—splitting across the breadth, or transversely; this the stretchers are calculated to prevent: secondly, splitting laterally, or along the length of the wall; this the headers are used to pre-

vent. Of the two evils the latter is the worst, and should, if possible, be avoided. As a means of securing this, English bond is to be recommended from frequency of the headers. Another advantage in English bond is, that the workman can proceed with laying the courses with considerable regularity, without requiring much of his attention, as the last course is in itself a guide, pointing out how the next is to be proceeded with: not so in the case of Flemish bond. "The adjustment of the bricks in one course must depend upon the course beneath, which must be seen or recollected by the workman. The first is difficult, from the joints of the under course being covered with mortar to bed the bricks of the succeeding course; and for the workman to carry in his mind the arrangement of the preceding course, is more than can reasonably be expected from him; and unless it be attended to, the joints will be frequently brought to correspond, dividing the wall into several thicknesses, and rendering it subject to separation or splitting." Where walls are built of a single brick, bond is obtained by making the bricks break joint. A new kind of bond has been recently introduced by Mr W. Austin, architect, as the "British bond," the principle of which will be best explained by a reference to fig. 136, which is the plan of paving, or a solid pier formed of the bricks by which this species of bond is formed. Their dove-tailed form, as will be seen, gives a very perfect bond, each brick having a very strong hold of its neighbour. Fig. 137 is a plan of a 1½-brick wall, a portion of which may be left hollow if desired, or may be filled in with bricks of a corresponding shape.

Fig. 136.

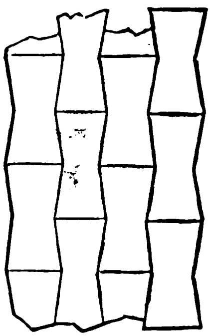


Fig. 137.

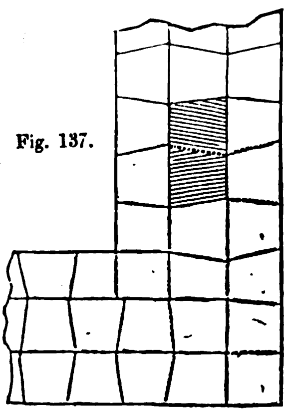


Fig. 138. Fig. 139.

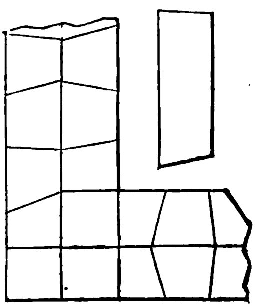


Fig. 138 is a 1-brick wall. Fig. 139 is a single brick of the form required for stretchers, the splayed form of which serves well for the outer reveals of doors and windows. Bricks of extra length are made so as to form a 1-brick wall, having vertical spaces through which hot

pipes can be led, or made useful for ventilating purposes. The address of Mr Austin, who will furnish further information, is Farnham, Surrey.

The method of building brick walls hollow, now demanding such wide-spread attention, is possessed of many advantages, two of these being more prominently noticeable—the saving of material, and the prevention of damp. The last is even of more importance than the first. Two other important advantages obtainable by the use of hollow walls, are—the saving of all lathing and preparation for plaster, the plaster being at once laid immediately on the inner face of the wall. We purpose to illustrate one or two plans of building hollow brick walls. The first we shall notice is that known as "Dearn's," which forms a 9-inch hollow wall. The lower courses up to floor-level are laid in ordinary English bond. The next course immediately above is formed by laying a series of "stretchers" on edge, thus leaving a space of 3 inches, as in fig. 140, which extends throughout the length of the wall. The next course is a row of "headers" laid flat, and so on. The sketch in fig. 140 shows elevation and section.

Fig. 140.

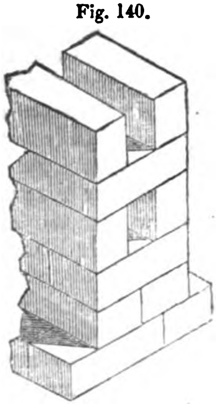
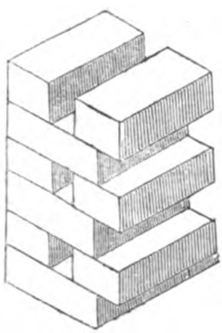


Fig. 141.



The 11-inch hollow brick wall introduced by Mr Loudon, and shown in fig. 141, is well adapted for cottage work: the projections left in the inside serve admirably to receive and retain the plaster. These 11-inch walls are formed by placing the "headers" 2 inches within the line of the "stretchers," thus leaving a hollow space of 2 inches in the centre of the wall. If one or two of the interstices at the top and bottom of the wall be here and there filled up with cement, so as to afford a hold for nails by which to secure vertical butts, by fastening paper or canvass immediately upon these, it is obvious that spaces will be formed in the inside of the wall as well as in the centre—thus adding another means for the prevention of damp. A 14-inch hollow wall may be constructed by placing two stretchers and a header on both sides of the wall, as in fig. 142, each row breaking joint with the other. With regard to the saving effected by the use of this method over that of building it solid, Mr Loudon says, "A rod of solid 9-inch brickwork requires 4500 bricks; a rod of hollow 14-inch, such as fig. 142, requires 3600;

and a rod with only half the amount of cross-bond, as in the figure, requires 3200 bricks." By using Dearn's 9-inch hollow wall, shown in fig. 140, a saving of one-third in bricks is effected. But the saving in mortar is also considerable, as may be seen by inspection of fig. 143, which is a plan of the sectional elevation of fig. 140. The mortar is only laid beneath the ends of the headers in the course above the stretchers on edge.

Fig. 142.

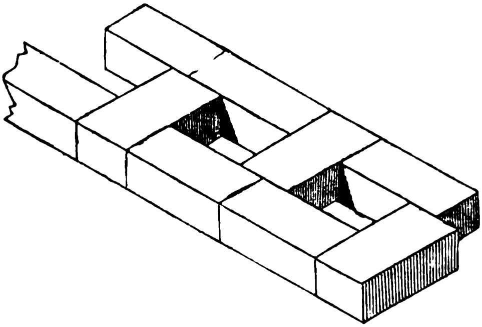
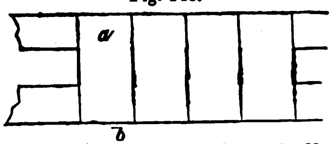


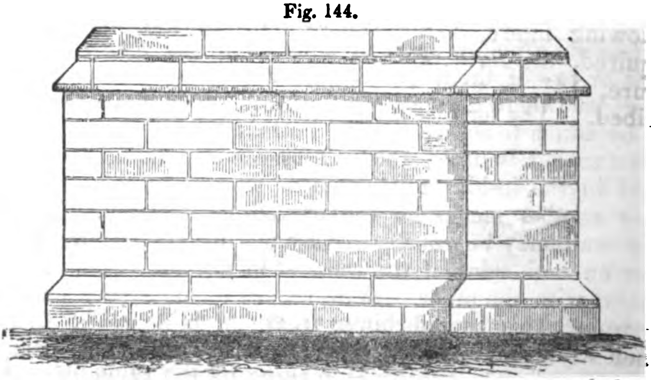
Fig. 143.



Although the principal hollow is only in every second course, still this form may be said to be hollow throughout, inasmuch as in the row of headers, a small space is left between each brick, at which no mortar is placed: their hollow spaces are indicated by the dark lines in fig. 143.

As may be seen by a reference to the description, Mr Austin's patent bonded bricks are useful in building hollow walls. The hollow brick walls constructed of the patent bricks of Mr Roberts are possessed of peculiar constructive advantages. They form a perfect bond; also, headers and vertical joints being avoided, they are consequently admirably adapted for the prevention of damp, as none can pass through these joints. They are also much lighter than ordinary bricks, from being equally burnt, and they

Fig. 144.



do not transmit heat or sound—the latter being a great recommendation where partitions are constructed by this method. They are capable of being made of any length, but 12 inches is preferred; the three courses rise 1 foot in height. This, with the omission of headers, reduces the number of joints by about one-third. When used for cottages, the expense of plastering may be saved. We now present a few illustrations of this important system. In fig. 144 we give the representation of an elevation of dwarf wall, of which, in fig. 145, we give a section.

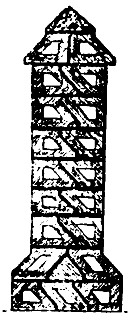
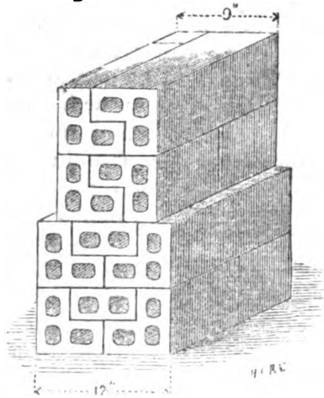
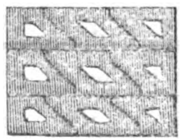


Fig. 145.



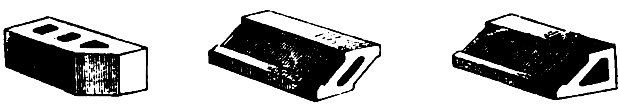
The section of a 14-inch hollow wall is shown in fig. 146.

Fig. 146.



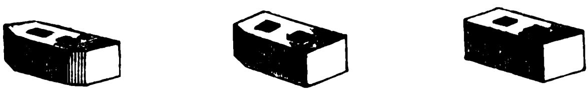
9-inch walls can be built by the use of the "external patent bricks," one of which is shown to the right of the cut in fig. 147, along with the "quoin brick," shown to

Fig. 147.



the left of same figure; and the "jamb brick" to the right of following figure, 148. Where walls thicker than 9 inches are required, the form of brick shown in the centre of the above figure, 147, is used in conjunction with the others just described. The form of brick shown to the right of fig. 148 is used

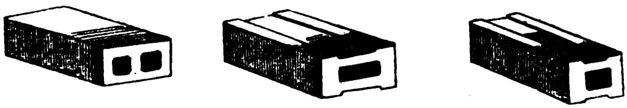
Fig. 148.



for internal jambs and chimneys, and is $8\frac{3}{4}$ inches long. The two other stretchers in this figure show how one or two angles may be chamfered in the process of making by the same die. The form

of brick seen to the right of figure 149 is used for 4½-inch

Fig. 149.



partitions, of which fig. 150 is a sectional elevation. These bond with the splayed bricks, and answer for floor and roof arches where the span does not exceed 7 feet. The form of brick shown in the centre of fig. 149 is used for 5¾-inch partition walls, also for arch bricks used for floor and roof arches, of from 7 to 10 feet span. The brick to the left is also used for partition or internal walls, with webb to give extra strength, and to adapt them for using on edge in partitions 3¾ inches thick, to rise in 6-inch courses. The method of setting these hollow bricks for window and door jambs on alternate courses is shown in figs. 151 and 152, and the plans of angles on alternate courses in figs. 153 and 154. Much economy is said to result from the use of these patent bricks. The inventor, an architect of established reputation, states that 9 patent hollow bricks of the size before described, viz., 12 inches in length, and calculated to rise 1 foot in three courses, will do as much walling as sixteen ordinary bricks; whilst the weight of the patent bricks but little exceeds that of the ordinary bricks—an important consideration with reference to carriage, and ease of handling. If niched at any desired part with a sharp-pointed hammer, they will break off easily, and the angles may be taken off with a trowel as readily as those of a common brick. The bricks for the quoins and jambs may be perforated for ventilating purposes, with perpendicular holes, either square, circular, or octagonal. As to the saving effected by their use, the following comparative statement of a rod of ordinary bricks, and a rod of the patent, will afford some information:—

Fig. 150.

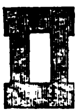


Fig. 151.

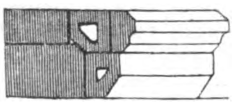


Fig. 152.

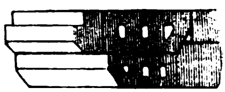


Fig. 153.

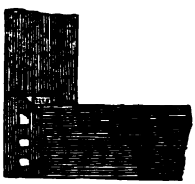
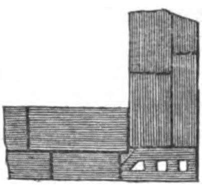


Fig. 154.

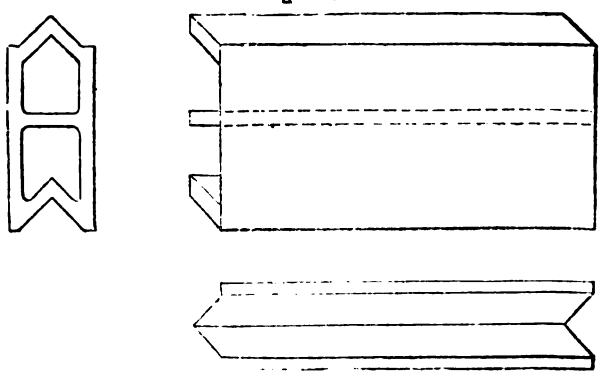


4000 ordinary bricks at 20s. . .	£4	6	0
2450 patent do. at 25s. . .	3	1	3
Saving in bricks per rod,	£1	4	9

4000 ordinary bricks at 24s. . .	£5	3	3
2450 patent do. at 30s. . .	3	13	6
Saving, ...	£1	9	9
4000 ordinary bricks at 28s. . .	6	0	5
2450 patent do. at 35s. . .	4	5	9
Saving, ...	£1	14	8

Being about 29 per cent in favour of the patent bricks, and of 25 per cent in mortar and labour. The following test as to the strength of the hollow bricks may be interesting: six bricks of good quality were put together so as to form a pier one foot long, one foot high, and nine inches wide; the external sides being seven-eighths of an inch thick, the internal three-fourths of an inch thick, it was found that a weight of 6½ tons caused a slight crack, only perceptible by sound, which did not increase until 8½ tons were placed on them. With 9 tons the horizontal beds gave way, the perpendicular sides remaining unbroken, and without any tendency in the bricks to separate. This experiment was made at the eminent architects and builders', Messrs Cubitt, of Gray's Inn Road, London. Hertslett's patent hollow bricks, as may be seen by inspection of fig. 155, are on the cellular principle, which gives them great

Fig. 155.



strength, combined with lightness. The stratum of air which they contain renders them bad conductors of heat and sound, and peculiarly fits them for partitions, where the weight of common brickwork would preclude its use, for drying ovens, for malt-kilns, for closing in boilers, and for numerous other purposes which will readily occur to the reader. We deem them peculiarly well adapted for filling in the spaces between wooden or iron columns in temporary agricultural buildings. From the frequency of the dovetail joints, in even a comparatively short wall, the bond is very perfect, and very little mortar will be required. One objection to hollow bricks manufactured *de novo*, is that, in making them, the core could not be supported except by a thin bar, which, as the brick issued from

the die, did in fact cut it in halves, to be afterwards joined by the cohesion of the clay. The joint, however, was liable to give way, and the bricks frequently split at that point. To obviate this objection, Mr T. Paris, of Barnet, has registered a mould for *solid* bricks, which, when built, form *hollow* walls. These bricks are made without a core, and the difficulty mentioned above is got rid of. They can be made of any clay, and can be burned in a clamp, which will render them much cheaper. As to the perfection of the bond, a mere glance at fig. 156 will show that there can be little doubt on this point. For temporary agricultural buildings they seem well adapted, no mortar being at all required: if the building is required to be in a measure air-tight, a little sand sprinkled between the crevices will effect this desideratum. Moon's patent hollow chimney bricks are peculiarly worthy of notice, as possessing numerous advantages, which will be at once obvious by a perusal of our remarks already given in the "Construction of Chimneys." These bricks meet a desideratum in building materials which has been long wanting. The following illustrations will convey to the reader all necessary information as to their construction and mode of use. Fig. 157 is a plan of "bond

Fig. 156.

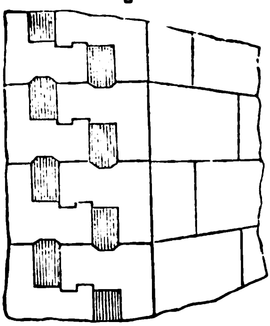
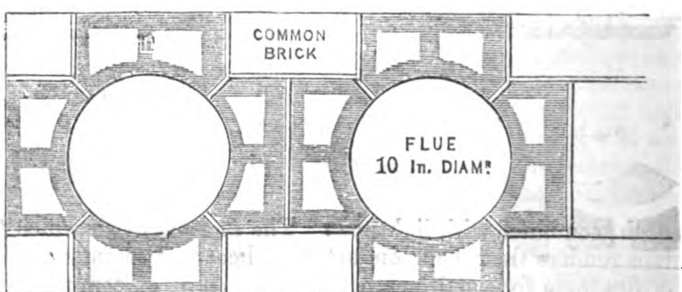


Fig 157.

Plan of Bond Course.



course;" fig. 158 plan of "stretcher course;" fig. 159 is plan of "shaft bricks;" fig. 160 is plan of "gathering brick," showing the method of using it in conjunction with common bricks. Fig. 161 shows a perspective view of a single brick for the bond course; and fig. 162 same for stretcher course; and fig. 163 a brick for external shafts. These bricks, used for the external shafts, are also adapted for building piers or pillars, and set upright as blocks for cornices. The *dies* for these bricks are to be had at

Mr Clayton's, Atlas Works, Upper Park Place, Dorset Square, London.

Fig. 158.

Plan of Stretcher Course.

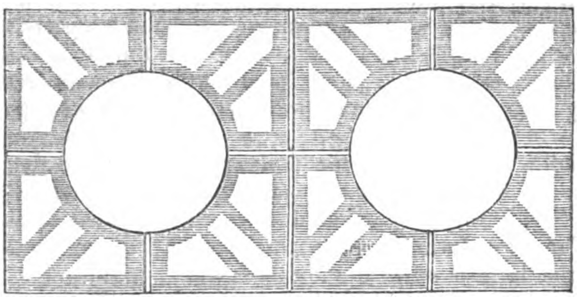


Fig. 159.

Plan of Shaft Bricks.

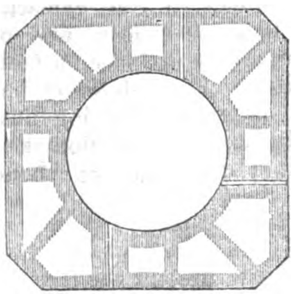


Fig. 160.

Gathering Brick.

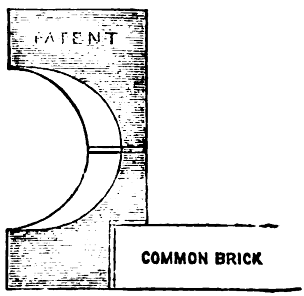
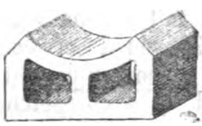
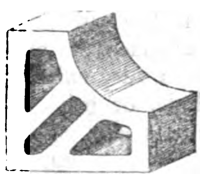


Fig. 161.



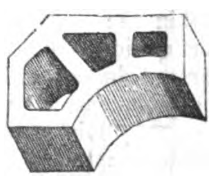
Bricks for Bond Course.

Fig. 162.



Bricks for Stretcher Course.

Fig. 163.



Bricks for External Shafts.

Stone for building is used in three ways; "rubble," in which the blocks or pieces are used of all sizes, without being squared; "coursed work," in which the pieces are in some measure sorted into sizes of a uniform bulk, and these built in courses; "ashlar," in which the stones are squared off to certain required dimensions. Ashlar is generally used for houses of a superior class, for fronting

or facing a rubble wall. The beds of ashlar-work should be carefully made; all hollows should be avoided, as, where these exist, the pressure is generally thrown on the edges of the stones, producing fractures, which impair the regularity and appearance of the work. Where ashlar is used to face brickwork with, care should be taken to work the stones so as to bond properly with the brick backing; where this is not attended to, the facing and backing will likely separate. The "bond" in stone-work is obtained by laying each course in such a way that its joints lie opposite the solid parts of the course below.

In building stone walls, the footings forming the foundations should consist of the largest stones which can be procured—that is, consistent with the proportion due to the intended thickness of wall. The best form to have them in is rectangular; if not square, the largest surface should be laid horizontally. Stones tapering downwards should not be used as footings without hammer-dressing; if tapering, or resting upon angular or irregular ridges, they are apt to sink and yield by the superincumbent pressure of the walls. If possible, the stones for the footings should be obtained of the full breadth. If a sufficient number of these cannot be obtained, the space between two of these may be filled up by stones of less dimensions, disposed like the stretchers in a brick wall. If stones sufficiently large, as above noted, cannot be obtained, then care must be taken to arrange the various pieces with relation to each other, that they may break joint. In well and strongly built walls, bond timbers will not be required: in fact, where they can at all be dispensed with, it is better to do so. In fronting with ashlar, the stones used for this purpose are recommended to be cut so as to present the form of truncated wedges; this taper should not extend from the back quite to the outer face, but within an inch or two. When each course is laid, they will present a range of angular interstices within the walls: now, if the rubble-work be laid so that the vertical joints and angular spaces of one course fall on the solid parts of the course below, a very efficient bond is formed between the ashlar facing and rubble, or brick backing. Another precaution to obtain good bond is also recommended by a competent authority: this is to sort the stones, so that "in each alternate course they will extend further into the wall than those of the course immediately above and below." Bond stones in ashlar must be of a rectangular form, and so disposed that they will be between the two bond-stones in the course above and below them.

PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 4.	42 11	32	19 10	31	39	36 7
11.	44 1	32 1	20 2	31 3	38 8	36 5
18.	46 5	30 8	19 4	31 8	39 10	35 2
25.	50 5	30 11	19 9	32	38 11	36 8
1853.						
Jan. 1.	50 2	30 11	19 11	32 2	37 1	34 8
8.	50 10	32 9	20 9	32	42 8	35
15.	50 10	31 6	20 6	32 1	37 4	35 9
22.	48 8	31 2	20 11	31 10	36 2	35 7
29.	49 9	34 2	21 2	32 2	36 9	34 3

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 1.	46 10	28 4	20	35	35 6
8.	49 7	28 10	20 11	36	36 8
15.	54	29 8	21	36 6	37 3
22.	50 3	29 10	21 6	34 6	36
29.	47 10	30 2	21 4	34 8	34 7
1853.					
Jan. 5.	50 1	30 3	20 10	34	34 8
12.	50 3	30 6	20 11	34 4	35 3
19.	50 8	31 10	20 7	34 2	35 4
26.	49 4	32 1	20 5	34 4	34 10

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 4.	40 7	30 8	18 2	26 9	32 4	36 3
11.	45 10	29 3	19	27 5	32	34
18.	46 6	28 1	19 2	26 10	33 1	34 9
25.	48 5	30 8	20 4	26 8	32 9	35 4
1853.						
Jan. 1.	45 4	34 3	20 2	26 6	32 6	38 4
8.	48 7	29 1	20 1	26 8	31 9	34 1
15.	48 6	28 6	20 7	27 2	30 9	32 2
22.	49 4	26 8	19 4	27	33 5	34 2
29.	49 1	29	20 6	28 3	33 2	33 2

DUBLIN.

Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bere, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour, p. barl. 9 st.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 3.	26 2	14 2	11 3	10 2	15 4
10.	26 8	13 9	11 4	10 5	15 6
17.	27 7	14 4	11 6	10 10	15 8
24.	28 4	14 6	12 3	11 6	15 9
31.	28 9	14 7	12 1	11 8	15 8
1853.					
Jan. 7.	29 6	14	11 8	11 1	15 10
14.	30 10	14 9	12 6	11 2	15 10
21.	30 1	15 5	11 10	10 11	15 11
28.	30 7	15 9	12 2	10 8	15 10

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vic., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1852.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 4.	41 2	40	30	30 1	18 5	18 4	30 11	27 9	32 8	32 7	35 5	35 3
11.	42 1	40 6	29 9	30 1	18 7	18 6	26 11	27 11	31 10	32 8	35 4	35 4
18.	43 10	41 3	29 9	30 2	18 5	18 6	29 2	28 7	32	32 5	34 6	35 2
25.	45 11	42 3	29 9	30 1	18 6	18 6	29 4	28 11	32 4	32 5	34 11	35 2
1853.												
Jan. 1.	46 7	43 4	29 8	29 11	18 9	18 6	29 7	28 10	32 9	32 4	35	35 1
8.	46	44 3	29 8	29 9	18 8	18 6	29 1	29 2	32 5	32 4	34 8	35
15.	45 10	45	29 10	29 9	18 7	18 6	30 8	29 3	30 7	32	34 8	34 10
22.	45 8	45 8	30 4	29 10	18 7	18 6	32 5	30 1	31 9	32	34 11	34 10
29.	46	46	31 2	30 1	18 7	18 7	32 2	30 7	31 10	31 11	34 9	34 10

FOREIGN MARKETS.—Per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1852-53.		s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Dec. ..	Danzig	44 6 - 50 0	24 0 - 30 6	16 0 - 20 6	24 6 - 30 0	26 6 - 32 6	26 0 - 31 6
Jan. ..	Danzig	45 6 - 52 0	25 0 - 32 0	16 6 - 21 0	25 0 - 30 6	28 0 - 36 0	28 0 - 34 0
Dec. ..	Hamburg	39 6 - 47 6	24 6 - 32 0	14 6 - 18 0	28 6 - 35 0	30 6 - 38 0	26 6 - 34 0
Jan. ..	Hamburg	40 6 - 49 0	25 6 - 33 6	15 0 - 18 6	26 6 - 33 6	28 6 - 36 0	24 6 - 33 0
Dec. ..	Bremen	36 6 - 44 0	24 0 - 30 0	13 6 - 18 0	26 0 - 30 0	29 0 - 36 0	26 6 - 33 6
Jan. ..	Bremen	38 6 - 48 6	24 6 - 31 6	14 6 - 19 6	27 6 - 31 0	30 0 - 36 6	27 6 - 34 0
Dec. ..	Königsberg	40 0 - 46 6	23 0 - 30 0	14 6 - 17 6	25 6 - 28 6	28 0 - 34 0	25 6 - 31 0
Jan. ..	Königsberg	42 0 - 48 0	24 0 - 32 0	15 0 - 18 6	26 0 - 30 0	28 6 - 35 0	26 6 - 33 0

Freights from the Baltic, 3s. 6d. to 6s.; from the Mediterranean, 7s. 6d. to 9s. 6d.; and by steamer from Hamburg, 2s. 6d. to 3s.

THE REVENUE.—From January 1852 to January 1853.

	Quarters ending Jan. 5. 1852.	1853.	Increase.	Decrease.	Years ending Jan. 5. 1852.	1853.	Increase.	Decrease.
	£	£	£	£	£	£	£	£
Customs....	4,559,512	4,541,384	..	18,128	18,761,069	18,695,382	..	65,687
Excise......	3,552,970	3,539,646	..	13,328	13,093,170	13,356,981	263,811	..
Stamps.....	1,427,485	1,615,029	187,544	..	5,933,549	6,287,261	353,712	..
Taxes......	1,185,922	1,419,873	233,951	..	3,563,962	3,377,843	..	186,119
Post-Office ..	246,000	272,000	26,000	..	1,064,000	1,022,000	..	42,000
Miscellaneous	70,574	112,008	41,434	..	322,241	553,729	231,481	..
Property Tax	367,956	468,238	100,282	..	5,304,923	5,509,637	204,714	..
Total Income	11,410,419	11,968,178	589,211	31,456	48,042,914	48,802,833	1,053,718	293,806
	Deduct Decrease		31,456		Deduct Decrease....		293,806	
	Increase on the qr...		557,755		Increase on the year		£759,912	

PRICES OF BUTCHER-MEAT.—Per Stone of 14 Pounds.

Date.	LONDON. Beef.	LONDON. Mutton.	LIVERPOOL. Beef.	LIVERPOOL. Mutton.	NEWCASTLE. Beef.	NEWCASTLE. Mutton.	EDINBURGH. Beef.	EDINBURGH. Mutton.	GLASGOW. Beef.	GLASGOW. Mutton.
1852.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Dec. ..	4 9 - 7 0	6 0 - 8 3	5 0 - 6 6	6 0 - 7 0	5 6 - 6 6	6 0 - 7 3	5 3 - 6 9	5 9 - 6 9	5 6 - 7 0	6 0 - 7 0
1853. Jan. ..	5 0 - 7 3	6 6 - 8 6	5 6 - 7 3	6 6 - 7 9	5 9 - 7 6	6 3 - 7 6	5 6 - 7 0	6 0 - 7 3	5 6 - 7 3	6 3 - 7 3

PRICES OF ENGLISH AND SCOTCH WOOL.—Per Stone of 14 Pounds.

ENGLISH.	s. d. s. d.	SCOTCH.	s. d. s. d.
Merino,	15 0 to 20 0	Leicester Hogg,	15 0 to 20 6
.. in grease,	11 0 to 15 6	.. Ewe and Hogg,	11 6 to 16 6
South-Down,	17 6 to 20 6	Cheviot, white,	14 0 to 16 0
Half-Bred,	16 6 to 19 0	.. laid, washed,	8 9 to 11 9
Leicester Hogg,	15 0 to 20 0	.. .. unwashed,	7 0 to 9 6
.. Ewe and Hogg,	12 0 to 17 0	Moor, white,	6 9 to 9 0
Locks,	7 6 to 9 6	.. laid, washed,	5 9 to 8 0
Moor,	6 3 to 7 6	.. .. unwashed,	5 6 to 6 6

INDEX.

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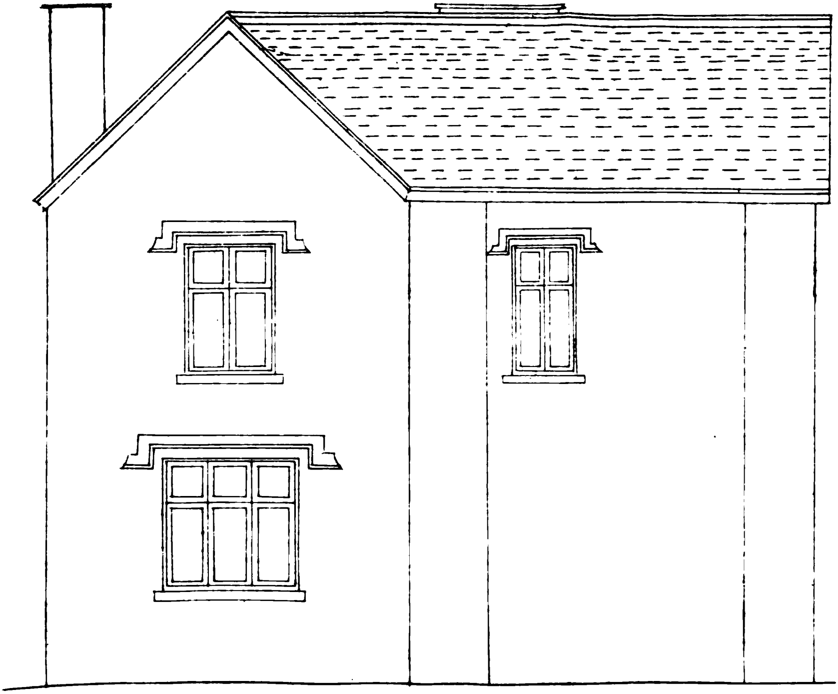
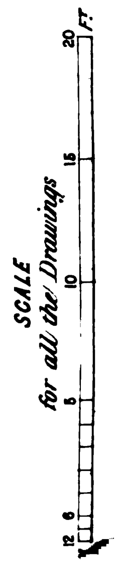
PAIR OF COTTAGES

FRONT ELEVATION

END ELEVATION



BACK ELEVATION



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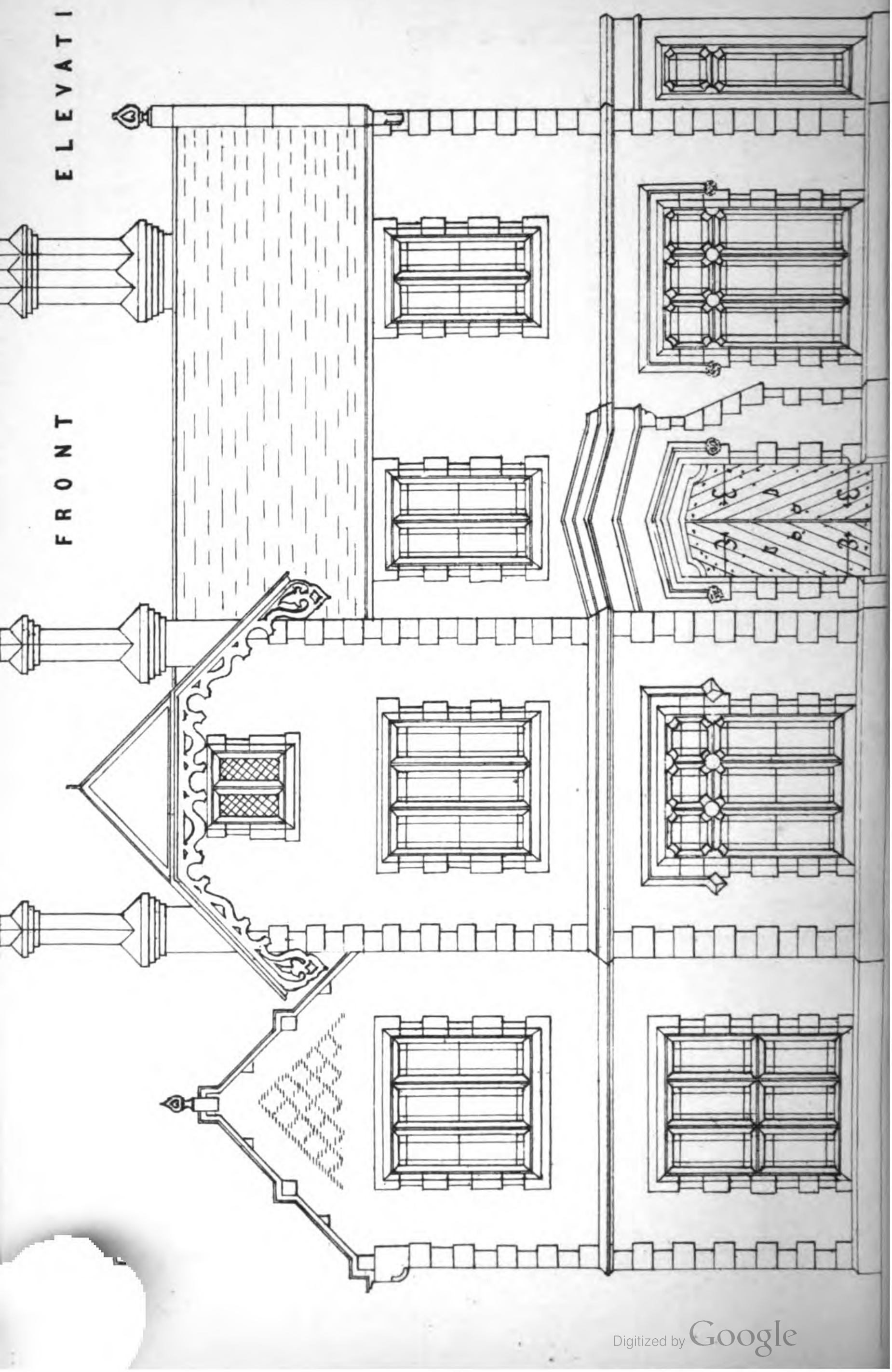
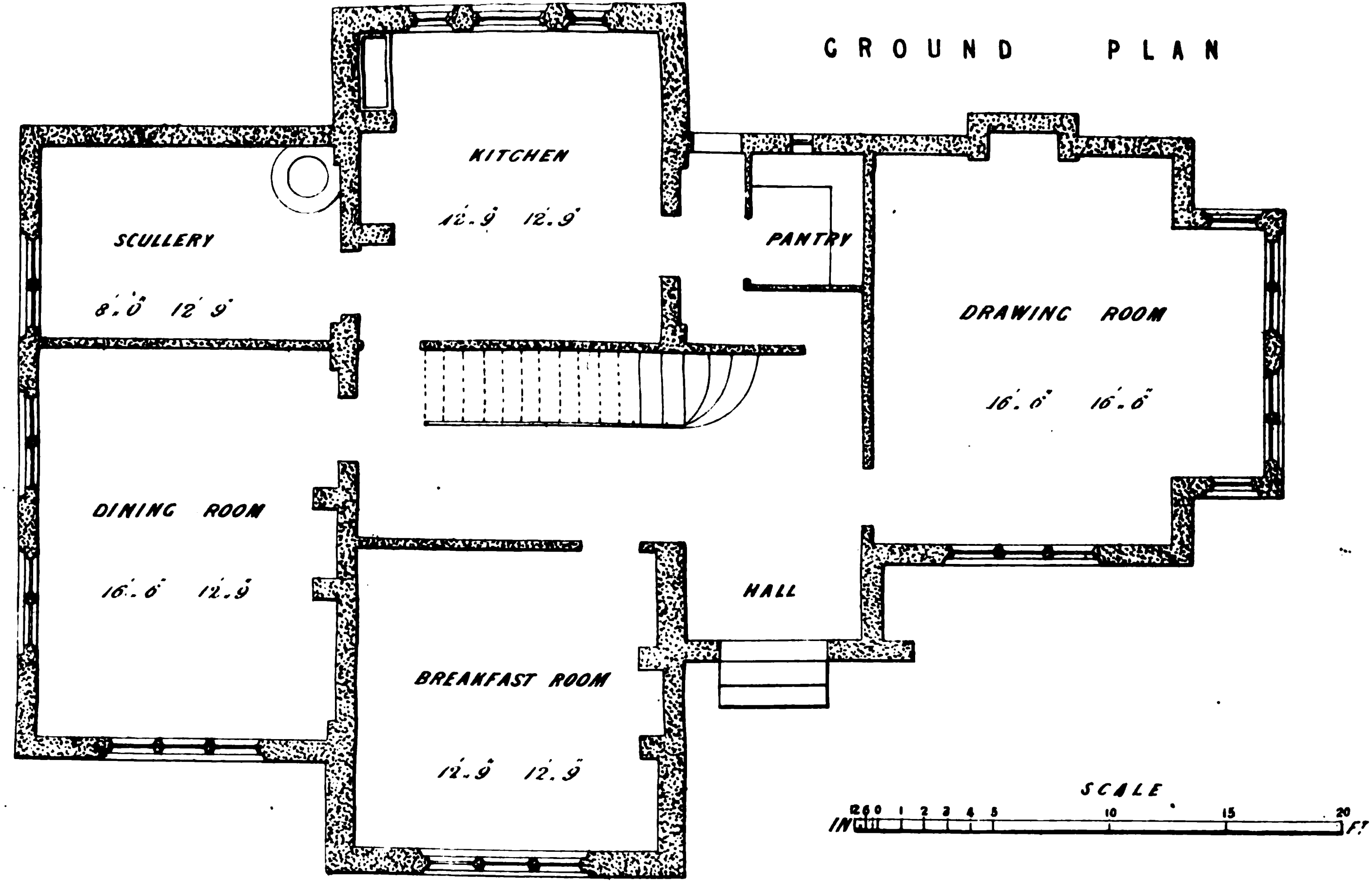
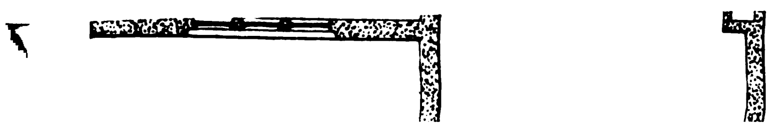


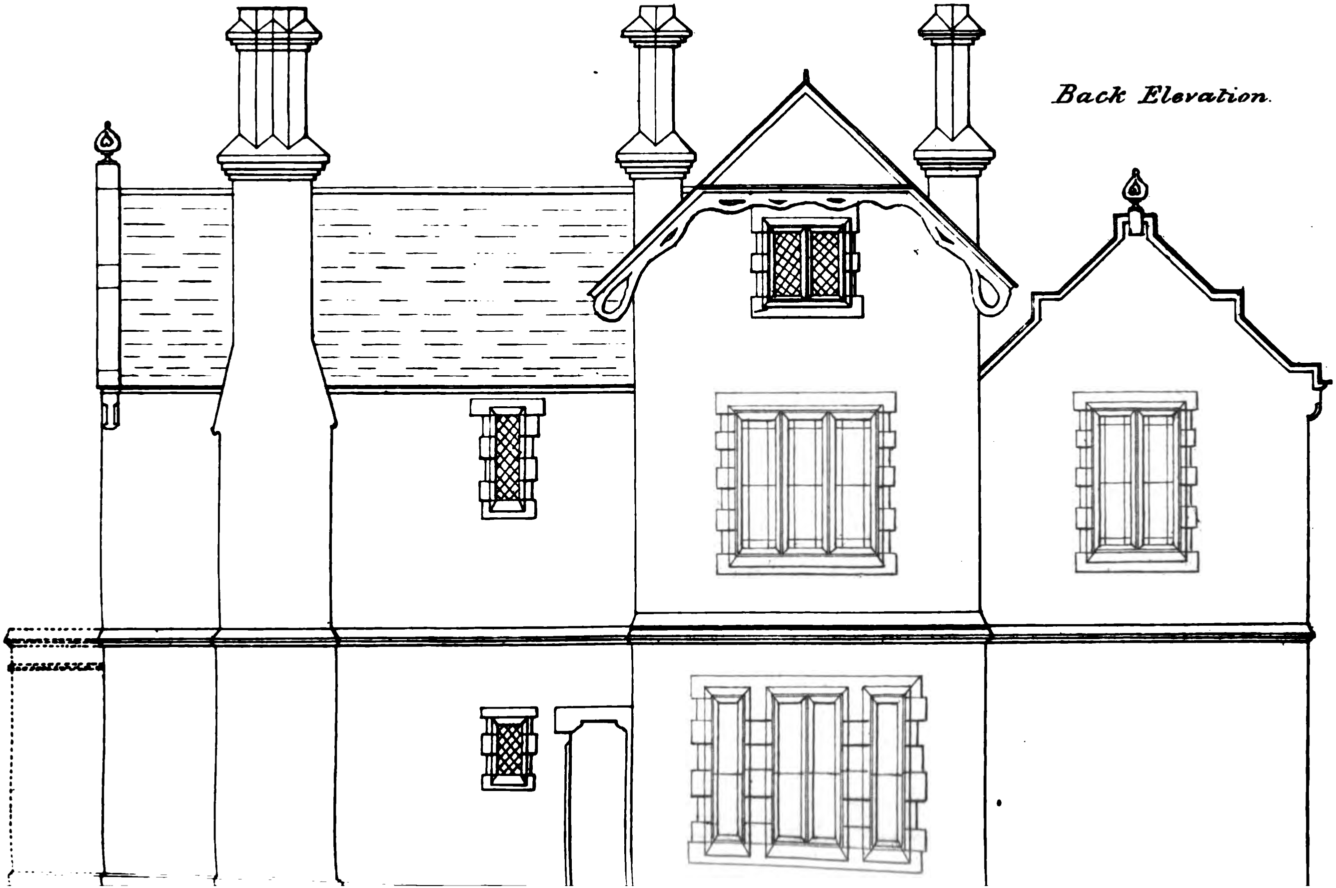
GROUND PLAN


KITCHEN
12.9 12.9
SCULLERY
8.0 12.9
PANTRY
DRAWING ROOM
16.6 16.6
DINING ROOM
16.6 12.9
HALL
BREAKFAST ROOM
12.9 12.9
SCALE
12 6 0 1 2 3 4 5 10 15 20
IN FT

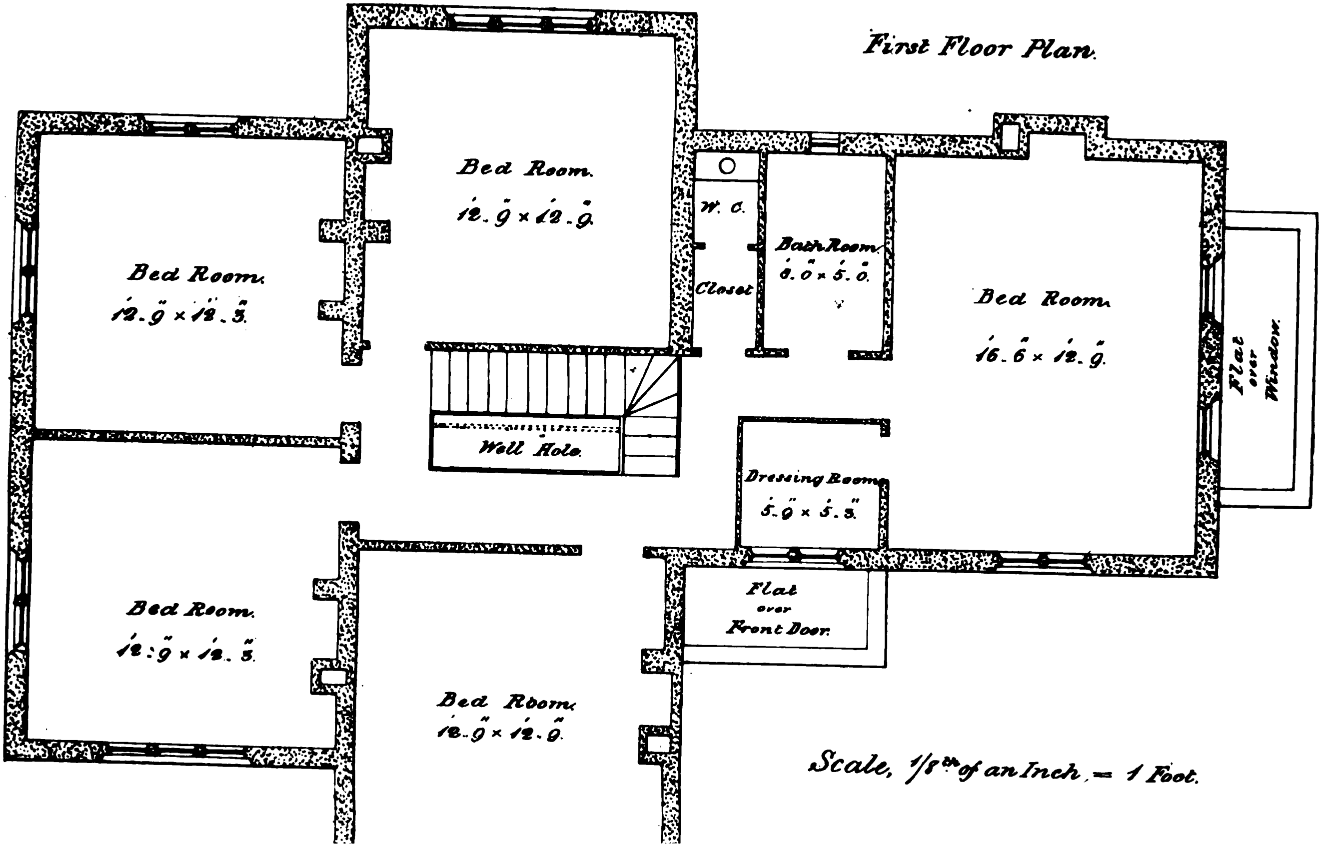


Scale, 1/8th of an Inch = 1 Foot.

Back Elevation.



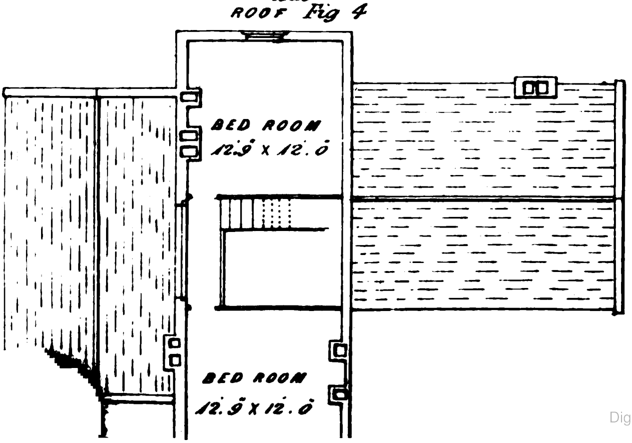
First Floor Plan.



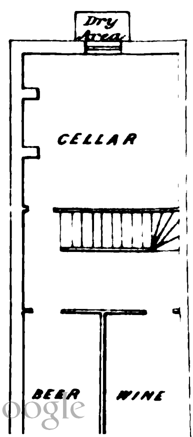
Scale, 1/8th of an Inch = 1 Foot.

SIDE ELEVATION
Fig 1

PLAN OF ATTIC and ROOF Fig 4



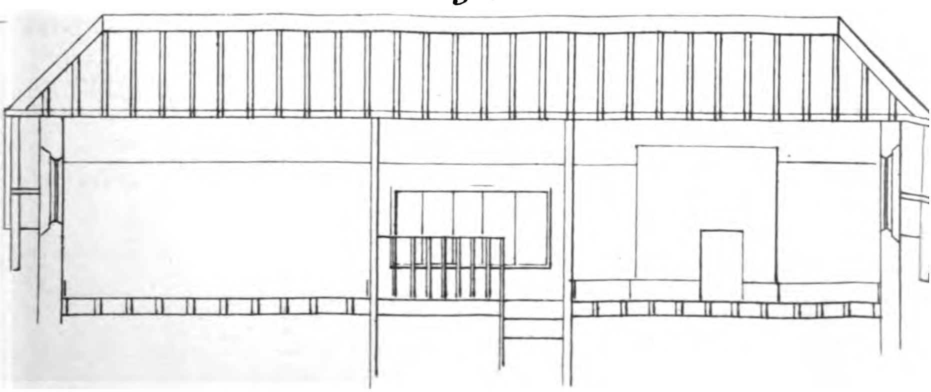
CELLAR PLAN F



END ELEVATION
Fig 2

Fig 3

5



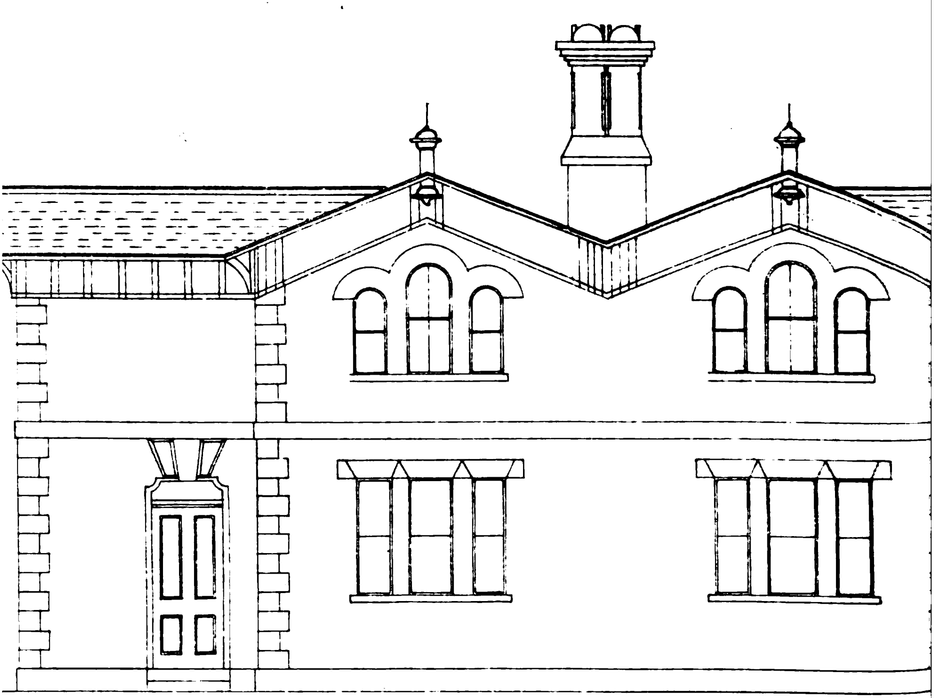
SCALE
for Figs. 1. 2 and 3

.26 0 1 2 3 4 5 10 15 20

SCALE
for Figs. 4 and 5.

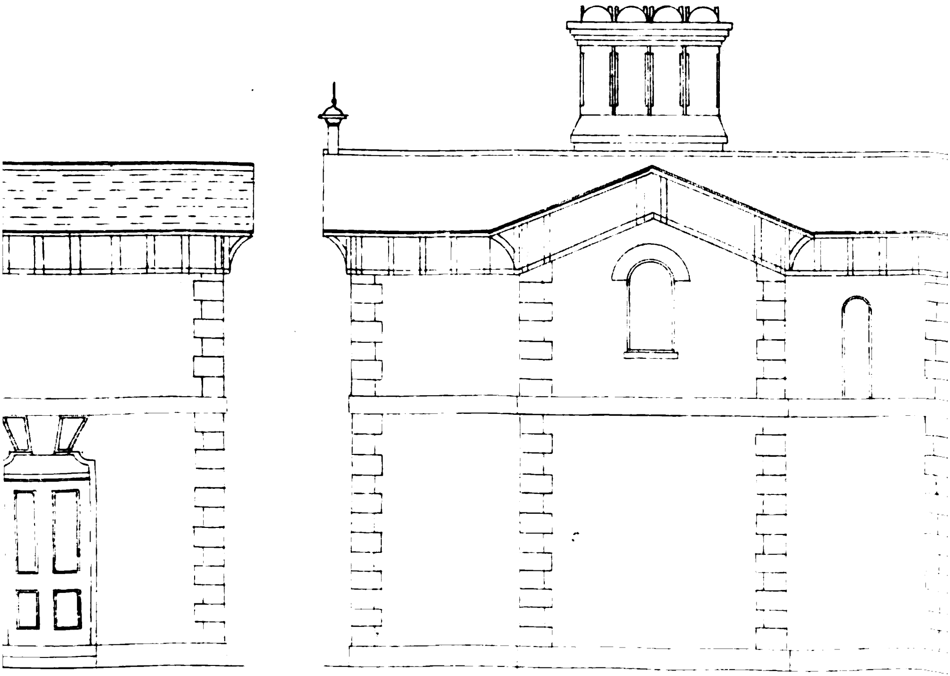
20 5 10 15

FRONT ELEVATION

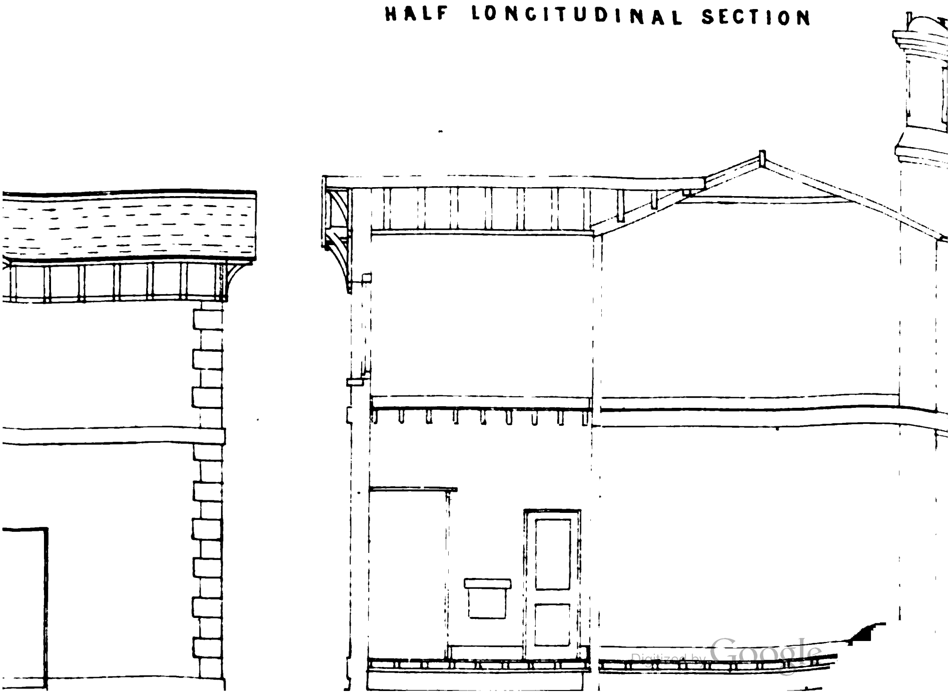


BACK ELEVATION

END ELEVATION

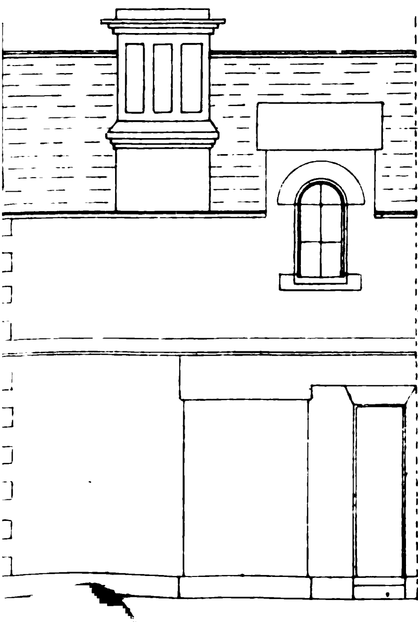


HALF LONGITUDINAL SECTION



(Fig 3) HALF BACK ELEVATION

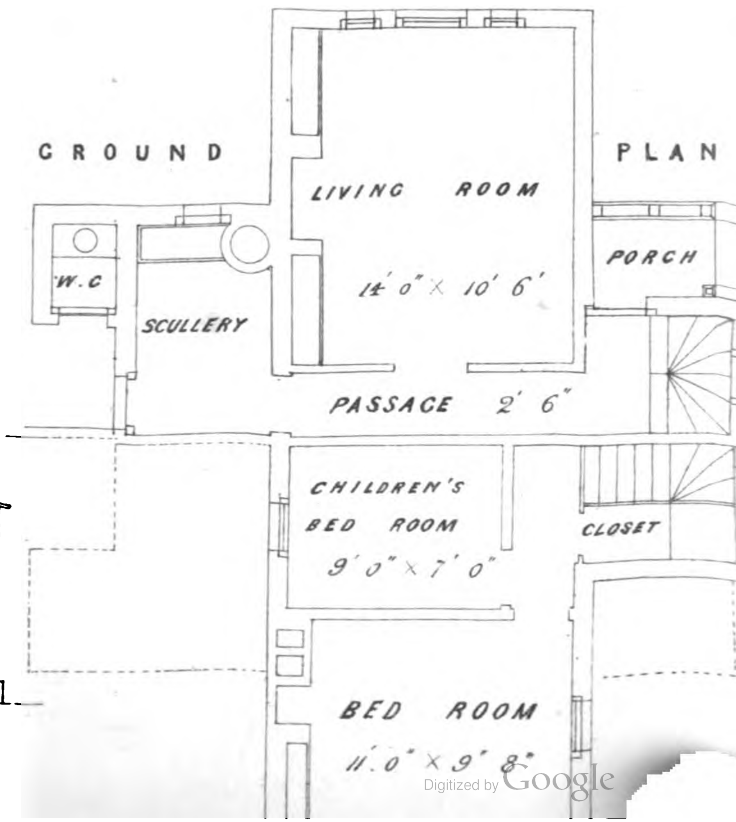
(Fig. 4) END ELEVATION

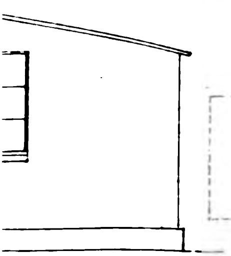


Scale for all the Drawings One eighth of an in:

(Fig. 2) FRONT ELEVATION

GROUND PLAN





.oot.

Fig 1.

Fig. 4

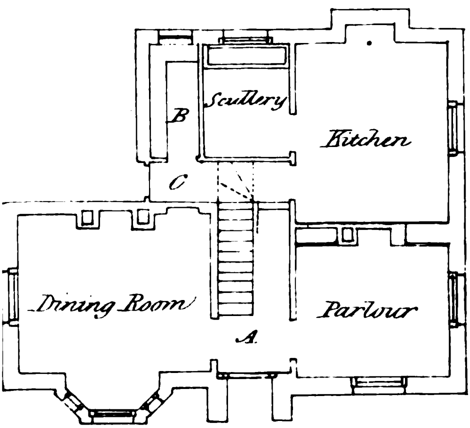


Fig. 5

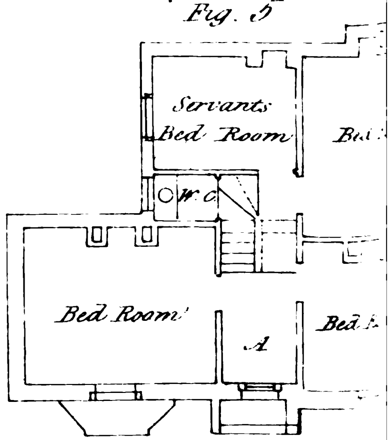
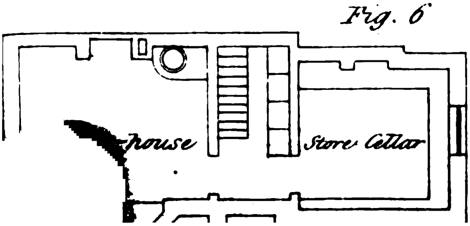
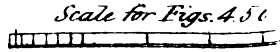


Fig. 6



Scale for Figs. 4. 5. 6



Scale for Figs. 1. 2. 3.

Fig 2.

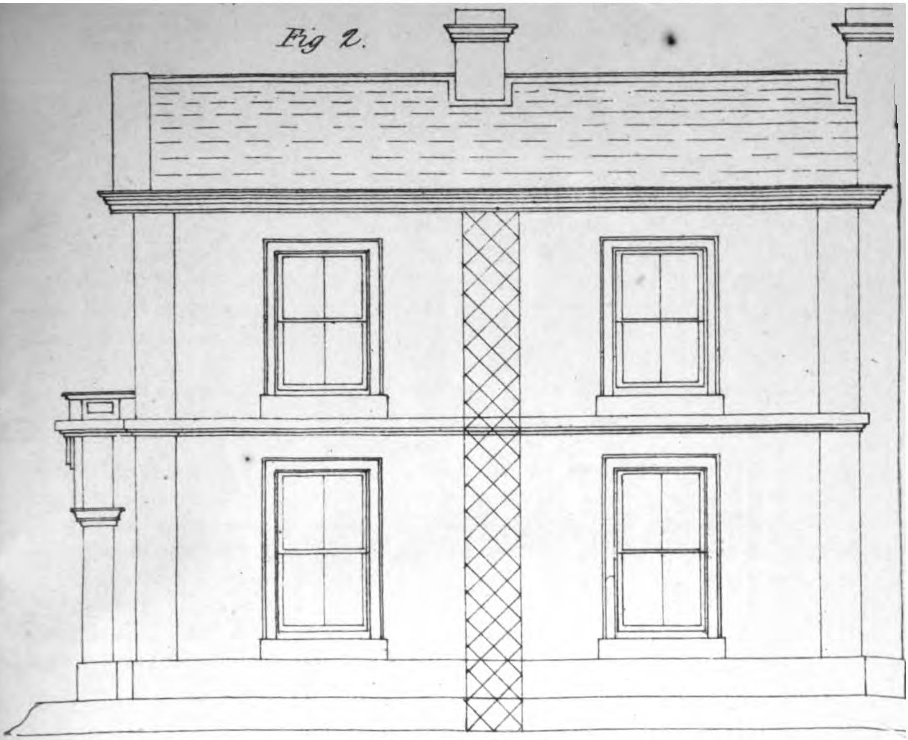


Fig. 3